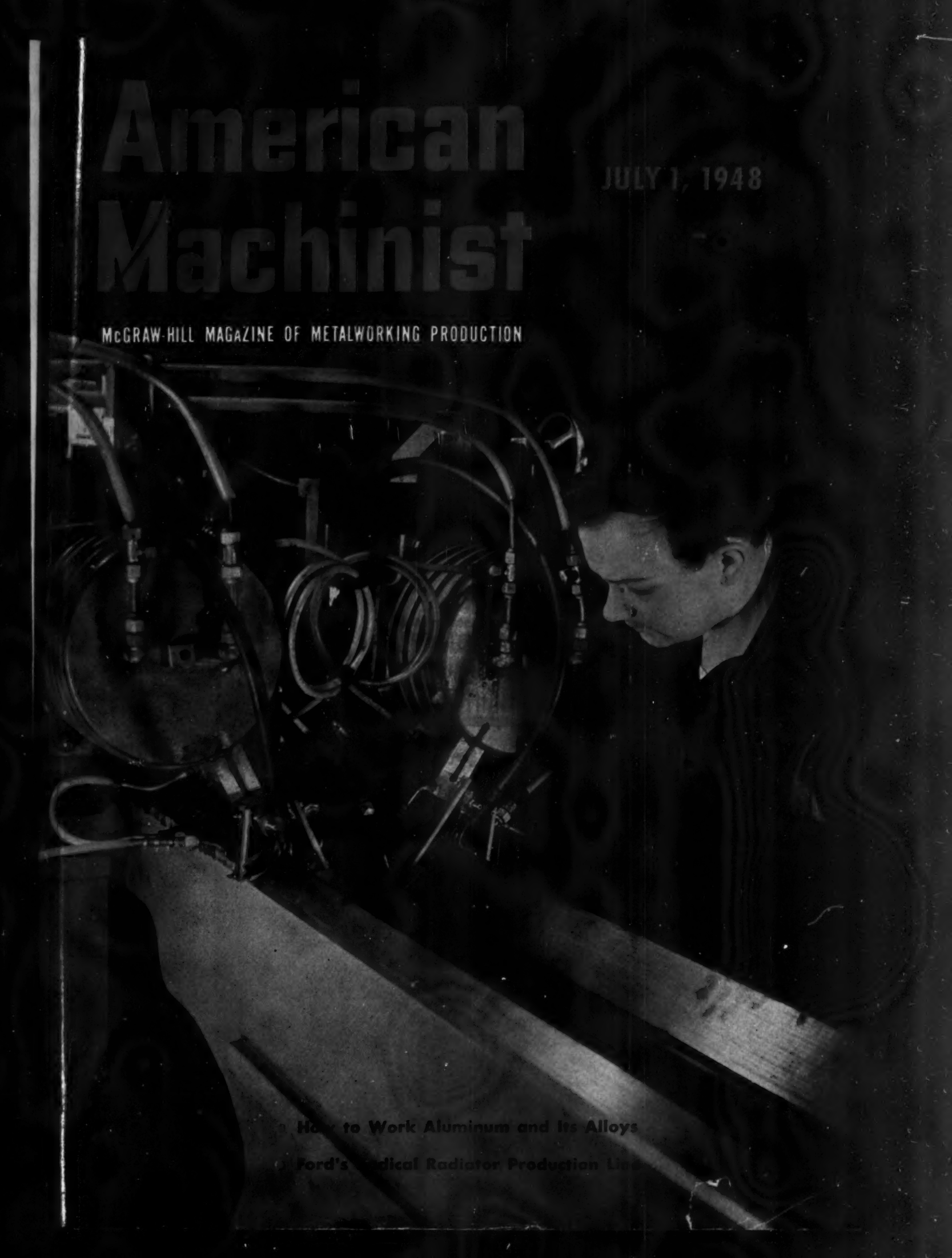
American Machinist

JULY 1, 1948

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION



How to Work Aluminum and Its Alloys

Ford's Medical Radiator Production Line

TR v.92A July-Aug. 1948

HERE'S THE NEW ANSWER TO LOWER-COST BORIZING OF LARGE WORK

...The New Heald MODEL 421 BORE-MATIC

It's *COMPLETELY NEW* in both DESIGN and PERFORMANCE

The new Heald Model 421 Bore-Matic is designed to provide new production speed and economy for all kinds of finishing operations on large work that require power, precision and versatility. Use it for boring, facing, turning, chamfering, grooving and flycutting in either light or roughing cuts.

Tooling can be adapted for any combination of either single, multiple or progressive operations in one or several stations. The bridge has capacity for up to four boringheads. Work can be either rotated or held stationary. Ample table pad area permits substantial fixtures.

Check the features listed at right . . . they're Heald's answer to industry's demand for lower costs. Send for literature . . . or let your Heald representative explain the advantages of this and other new Heald Bore-Matics in your own production setup.

Here's How the New Bore-Matics can

Boost your production . . . faster table traverse, quicker starting and stopping of heads, higher speeds, more power, easier operation, faster setups *increase output.*

Improve your accuracy . . . isolated hydraulic power unit, low-temperature hydraulic system, ventilated base and bridges, cool-running heads *eliminate heat distortion, improve accuracy and finish* — constant feed throttle *gives uniform feeds* — perfected way lubrication and cylinder design *produce smoother table motion.*

Cut your costs . . . centralized controls, improved dogs, interchangeable valves *speed up setups* — automatic lubrication, removable power unit, leakproof piping, self-adjusting brakes, easy-to-remove guards, dust proof electrical box *reduce maintenance, cut down time.*

HEALD

THE HEALD MACHINE COMPANY, Worcester 6, Mass.

Branch Offices in Chicago • Cleveland • Dayton • Detroit • Indianapolis • Lansing • New York

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American Machinist

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WHAT'S NEW?

...a lot of features on the new Dial Type!

With one lever, the operator changes spindle speeds and feeds throughout their complete range; at the front of the machine or at the rear operating position, as he is doing here.

"What's it got that we don't already have?" You've heard that statement many times and in many ways, and it's a good question to ask yourself when considering new shop equipment. In the field of milling, the new CINCINNATI Dial Types have everything you need in general-purpose machines.

They're easy to operate . . .
speeds and feeds are changed by power, at the front and rear working positions, and without effort, as the operator is doing in the illustration at the left. Think what this means in more efficient operation when a variety of cutters are required for the job!

The new CINCINNATI Dial Type Milling Machine. No. 3 High Speed Vertical illustrated above.

They're convenient to operate . . .
power feed controls are directional; fitted with plastic knobs. Plain and Universal Dial Types have complete front and rear controls to help the operator turn out better work.

They'll take a real cut . . .
Dynapoise overarm and rugged spindle drive powered by 7½ hp (No. 2), 10 hp (No. 3), 15 hp (No. 4) motors, are factors which you can't afford to overlook.

The new CINCINNATI Dial Type Milling Machines have many other features of value in low cost toolroom operation. You may find out more about them by writing for catalog M-1623.

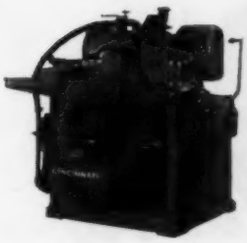
Left: The new CINCINNATI Dial Type Milling Machine. No. 2 Plain High Speed illustrated. Nos. 2, 3 and 4 sizes available; high speed and medium speed; plain, universal and vertical. Catalog M-1623.

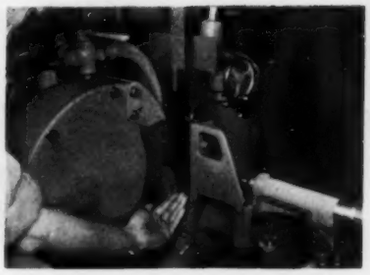
THE CINCINNATI MILLING MACHINE CO.

CINCINNATI 9, OHIO, U. S. A

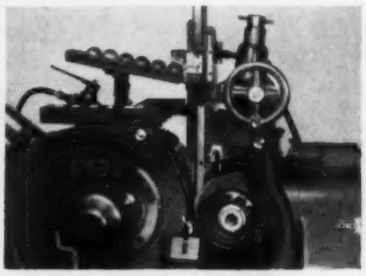
CINCINNATI

MILLING MACHINES • BROACHING MACHINES • CUTTER SHARPENING MACHINES
FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID





CINCINNATI FILMATIC No. 0 Centerless Grinding Machine. Catalog G-576. The No. 0 in the close-up has been equipped with a magazine fixture to grind small drills, five of which are in the operator's hand.

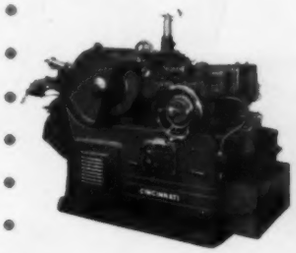


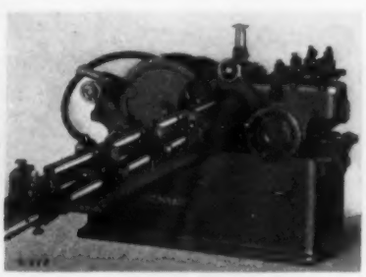
CINCINNATI DUAL FILMATIC No. 2 Centerless Grinding Machine. Catalog G-574. The No. 2 at the right has been tooled up to finish grind 20 sizes of pool and billiard balls, removing about .025" stock.

There's a size for your kind of work

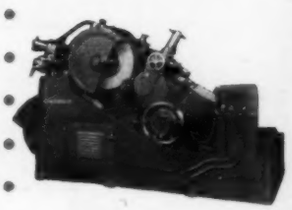
CINCINNATI FILMATIC Centerless Grinding Machines are built in six sizes... Nos. 0, 2, 3, 4, 5, 6

One user grinds surgical sutures, another grinds balance staffs for watches and clocks, and still another grinds steel bars—finished warehouse stock—on CINCINNATI FILMATIC Centerless Grinding Machines. Whatever your requirements may be, or the size of work, or the material from which it is made, Cincinnati can supply the correct centerless grinding machine. They are available in six sizes: Nos. 0, 2, 3, 4, 5, 6. All of them have FILMATIC Grinding Wheel Spindle Bearings, an outstanding favorite with grinding men everywhere. And a wide selection of accessories and equipment is available for standard machines . . . FEEDMATIC Hoppers for automatic and continuous feeding; profile and radius wheel truing equipment; four types of bar grinding equipment: automatic infeed attachments. ¶The Cincinnati centerless method of rapid, precision grinding offers many cost cutting advantages. Our Application Engineers will be glad to explain further. Meanwhile, write for literature mentioned here.

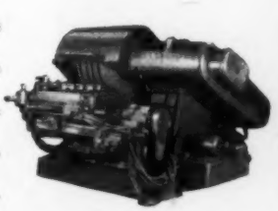


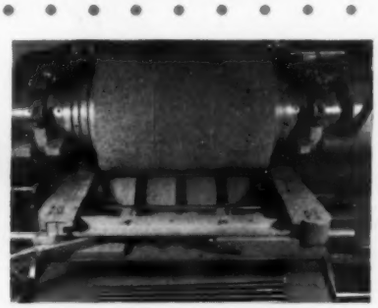


CINCINNATI FILMATIC No. 3 Centerless Grinder. Catalog G-570. The illustration at the right shows one of these machines equipped with a Type D Long Bar Grinding Attachment for grinding steel bars from 1 to 4 in. diameter.



CINCINNATI FILMATIC No. 4 Centerless Grinding Machine. Catalog G-538. At the right a No. 4 having increased capacity, is grinding the O. D. of 12 in. bearing races, square with the previously ground faces.





CINCINNATI FILMATIC No. 5 Centerless Grinder. Specifications on request. The No. 5 in the close-up is infeed grinding the complete length of 22 calibre rifle barrels. Up to 75 hp motors may be used.

FILMATIC

CINCINNATI

CINCINNATI GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

CENTER TYPE GRINDING MACHINES • CENTERLESS LAPPING MACHINES • CENTERLESS GRINDING MACHINES

"Full-Tool" Shaving in Step

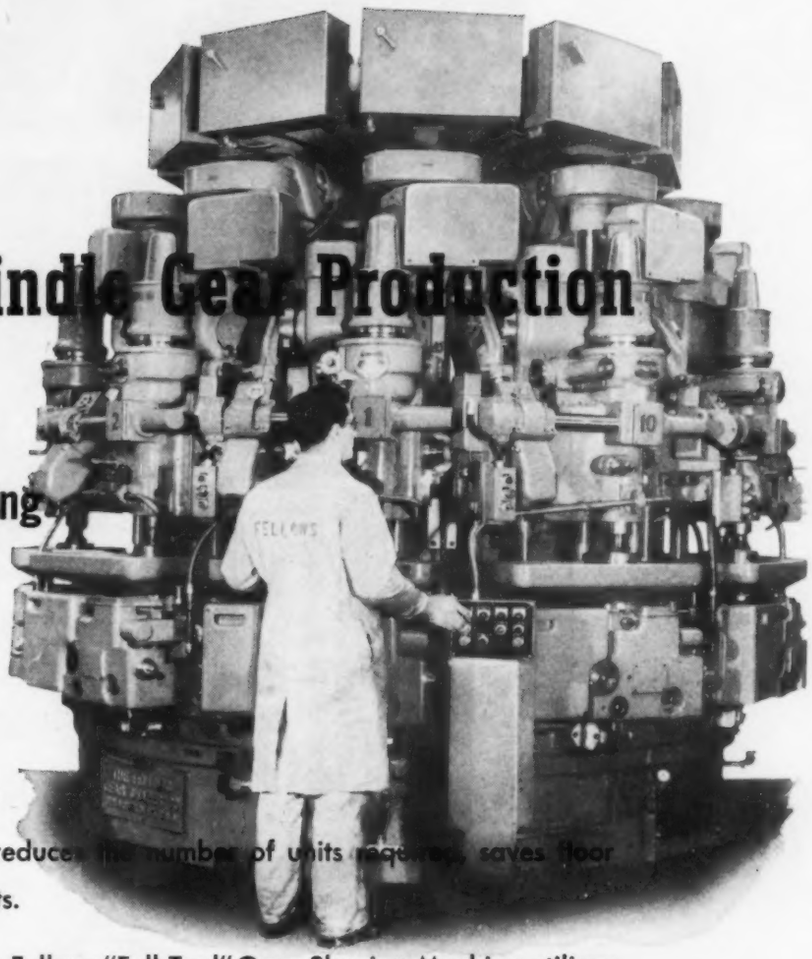
GEAR DETAILS

⬅ GEAR A		⬆ GEAR B
SAE 1050	Material (Steel Forging)	SAE 1024
23	Number of Teeth	23
16	Normal Pitch	10
20°	Normal Pressure Angle	14°
15°47′43″	Helix Angle	42°36′30″
1¼″	Face Width	1″
.0002″	Lead Limit	.0002″
.0005″	Involute Limit	±.0004″

GEAR SHAPERS • THREAD GENERATORS • CUTTERS • SHAVING AND BURNISHING MACHINES

Speed

with Multiple-Spindle Gear Production



- **Production on a single Fellows "Full-Tool" Shaving Machine in many cases equals the output rate of a multiple-spindle gear cutting machine**

Such high production per machine reduces the number of units required, saves floor space, overhead, and operating costs.

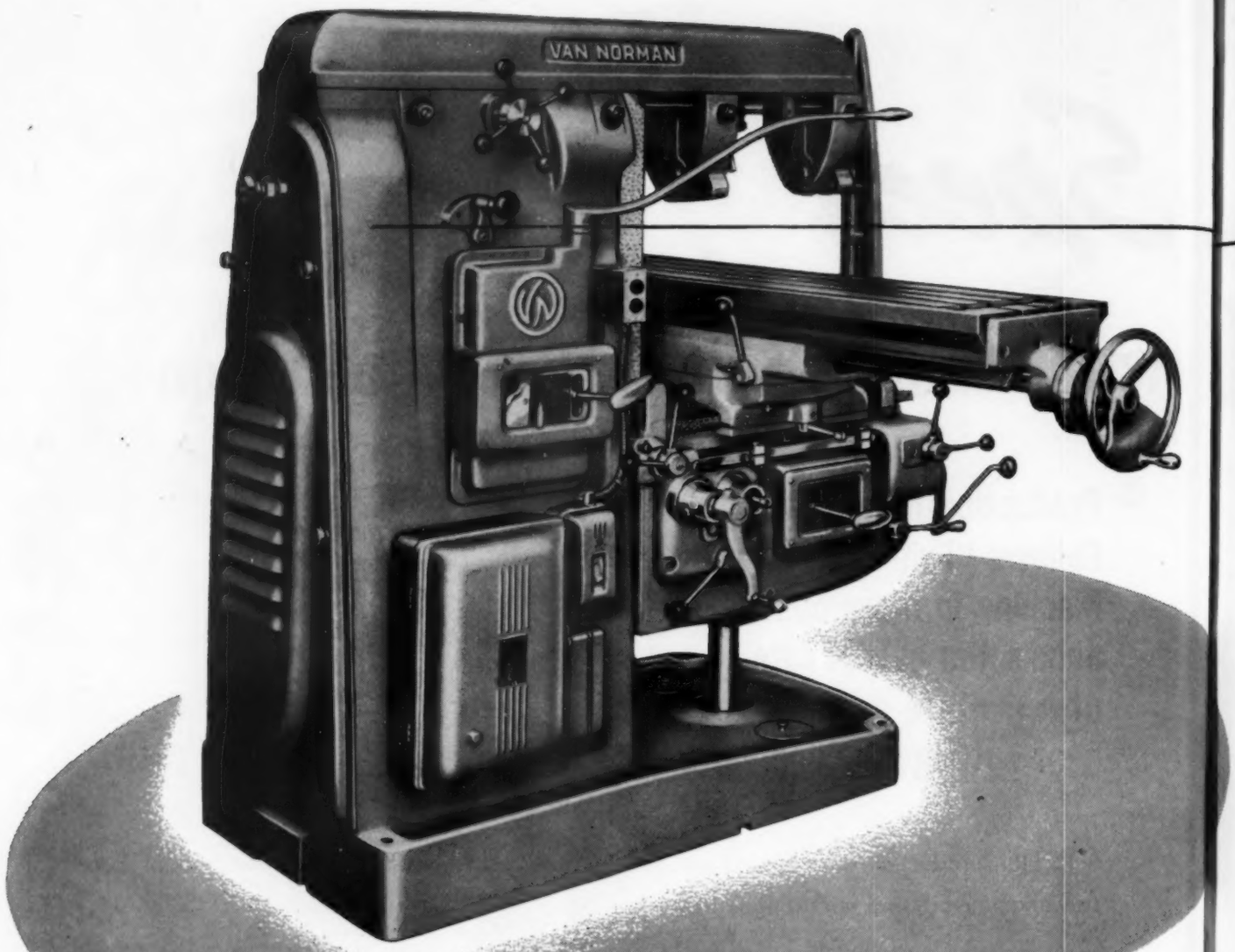
The improved tool-application on the Fellows "Full-Tool" Gear Shaving Machine utilizes higher reciprocating speeds and provides (1) freer cutting, (2) also a finer finish, (3) coupled with less wear and consequently longer life of the shaving tool.

Every plant manager utilizing the latest methods of gear production will want to know more about the Fellows "Full-tool" method of faster low-cost gear finishing. For complete information write or call the office nearest you.

Fellows

THE FELLOWS GEAR SHAPER COMPANY
Head Office and Export Dept., Springfield, Vermont. Branch Offices: 616 Fisher Bldg., Detroit 2; 640 West Town Office Bldg., Chicago 12; 7706 Empire State Bldg., New York 1.

GEAR MEASURING AND INSPECTION INSTRUMENTS • PLASTICS MOLDING MACHINES



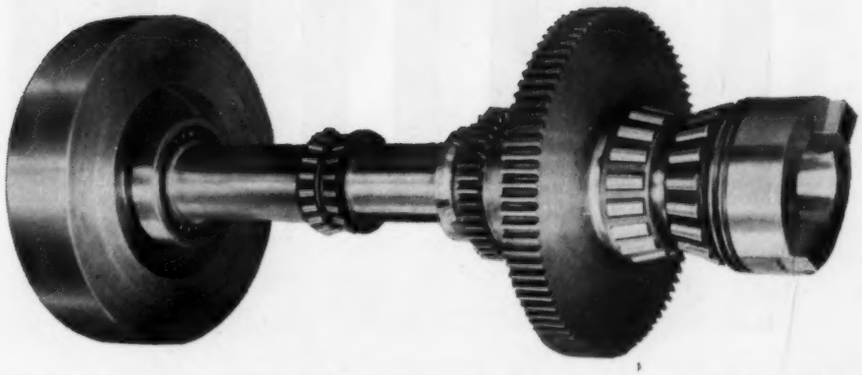
Van Norman No. 3 STANDARD

HORIZONTAL MILLING MACHINE

Especially designed for a wide range of general purpose and production milling, the Van Norman No. 3 Standard Miller provides many advantages that speed up production and cut costs.

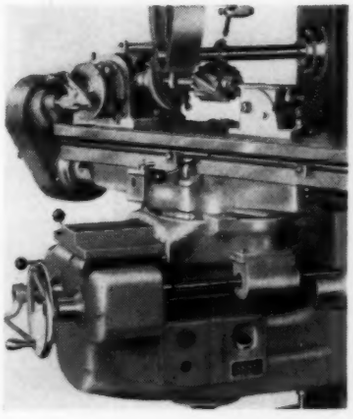
Heavy built-in spindle flywheel increases the cutability of the machine . . . assures smoother work finish. Front and rear directional controls of all power feeds, six-way rapid traverse, and hand adjustments provide convenience of control and operation. Single lever feed selector and single lever speed selector permit quick, easy selection of 18 speeds or 18 feeds. Overarm pilot wheel permits easy positioning of heavy overarm. These plus other Van Norman features assure high speed, cost cutting milling on all types of work. The No. 3 Standard is available with plain or universal saddle. Write for information.

VAN NORMAN COMPANY

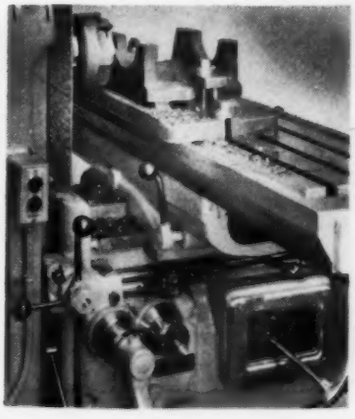


Heavy Built-in Spindle Flywheel Improves Cutability and Accuracy of Van Norman No. 3 Standard Milling Machine

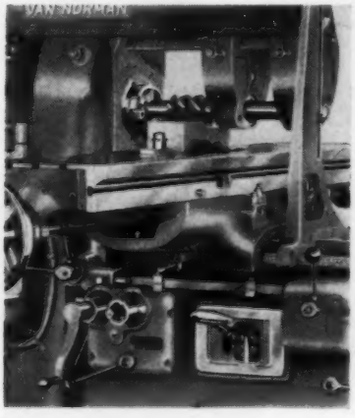
One of the outstanding advantages of the Van Norman No. 3 Standard Miller is the spindle design which incorporates a heavy built-in Spindle Flywheel and 5 anti-friction bearing support. The heavy flywheel provides smooth uninterrupted transmission of power to the cutter. It increases workability and improves finish on the work piece. The 5 anti-friction bearings . . . double-opposed in front, double-opposed in center, and single in rear . . . support the large alloy steel spindle. They assure maximum rigidity and spindle strength under all types of cuts.



No. 3 Standard Universal Milling Machine set up with vertical swivel dividing head and enclosed gear drive for milling a spiral cutter.



The flywheel on spindle of No. 3 Standard Milling Machine assures smooth application of power to the carbide face mill.

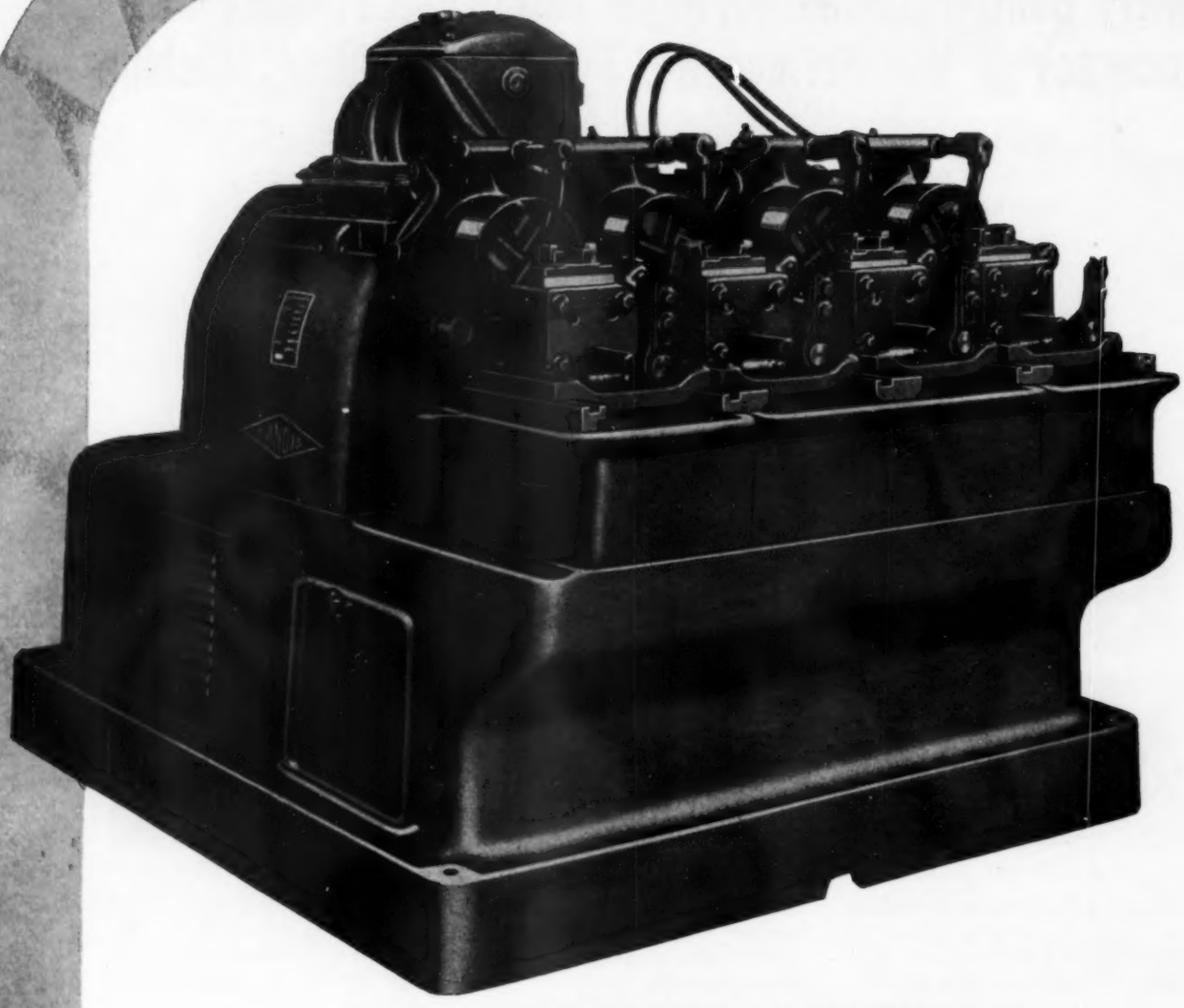


Production milling with helical plain milling cutter. Heavy duty feed and speed transmissions with large column and knee provide maximum rigidity.

SPRINGFIELD 7, MASSACHUSETTS

LANDIS

SEMI-AUTOMATIC



OUTSTANDING ADVANTAGES ARE:

- Low Labor Cost per piece
- Quick Set-Ups
- High Production at Low Threading Speeds
- Flexibility for all Diameters and for Special Threading Operations
- Elimination of Side Shave at Start of Thread
- Thread Concentricity

LANDIS MACHINE

4 SPINDLE

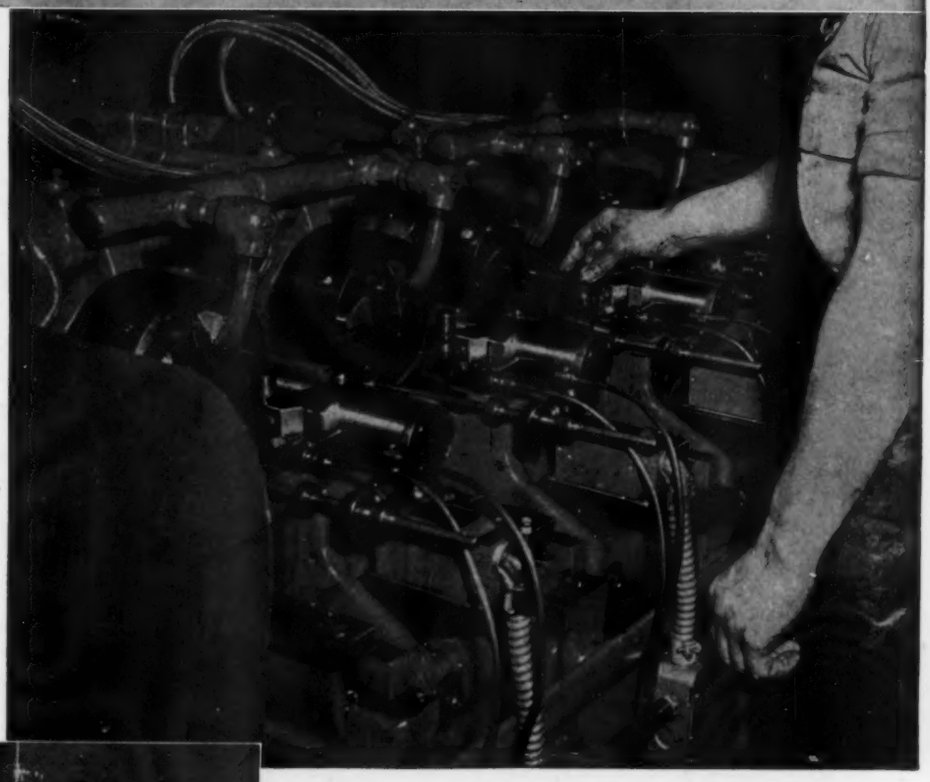
THREADING MACHINE

The Landis 4-Spindle Semi-Automatic Threading Machine is a precision machine designed for threading automotive parts, bolts, studs, rods, etc.

Average production ranges from 500 to 2000 pieces per hour, depending upon diameter and thread length.

The machine illustrated is cutting a 3/8" diameter 24 pitch thread 2-3/16" long on bar stock with a production of approximately 400 pieces (800 threads) per hour, reducing the threading cost 40% over previous methods.

Write for Bulletin No. 88



THE LANDIS CHASER

COMPANY

LANDIS REG. U.S. TRADE — MARK PAT. OFF.

WAYNESBORO PENNA., U. S. A.

NEW VISUAL-AUTOMATIC SIZING

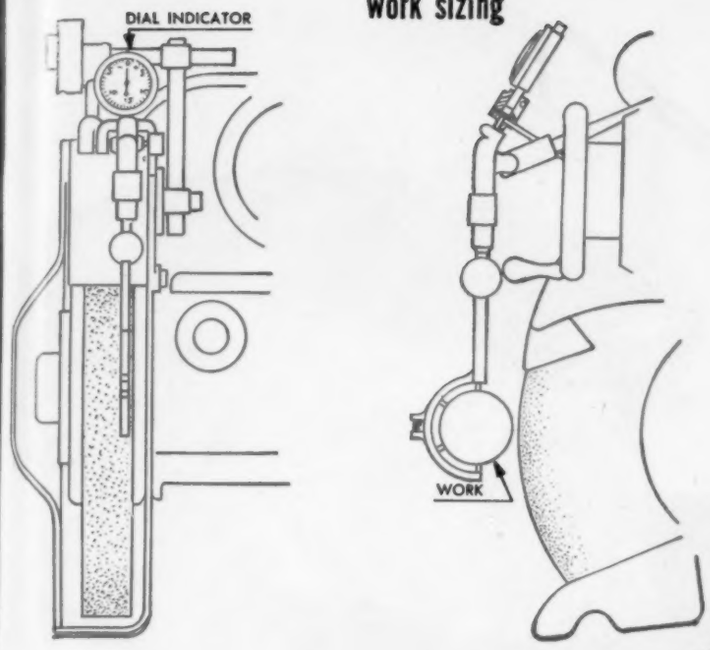
a **LANDIS TOOL** development for high production with high precision

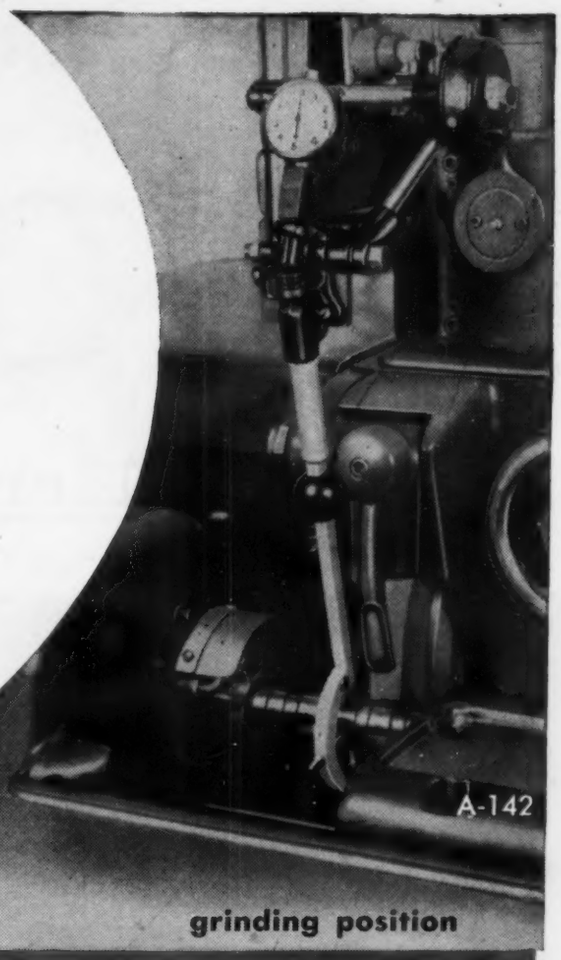
EQUIPPED WITH MICROSPHERE BEARINGS

LANDIS TOOL

Precision Grinders

work sizing

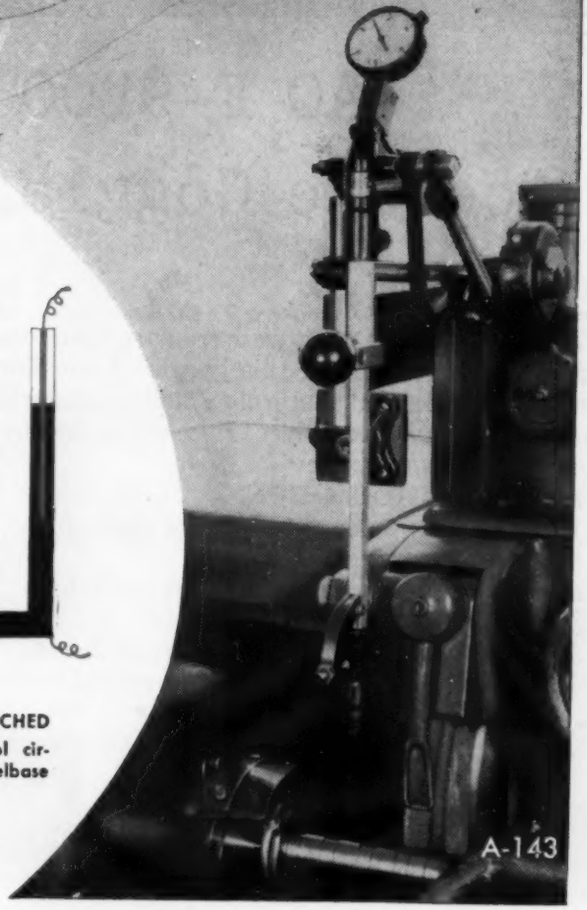




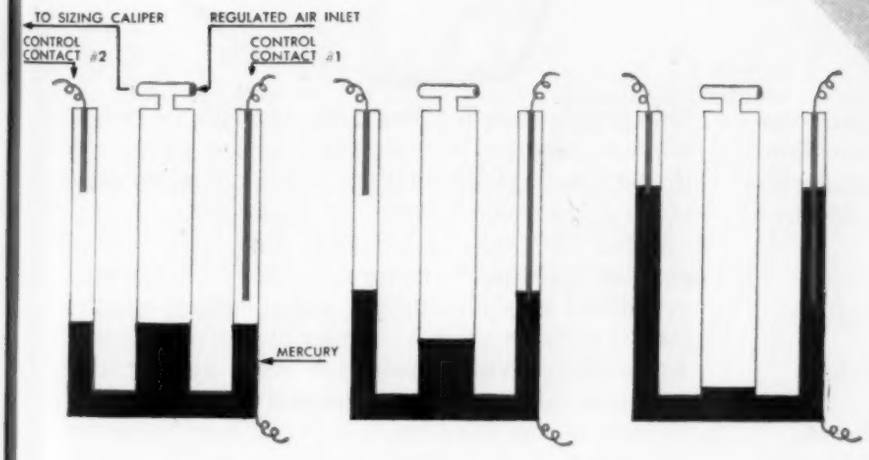
grinding position

HOW VISUAL AUTOMATIC SIZING WORKS

load and unload position



sizing control cycle



START OF GRIND
—Control circuits open.

APPROACHING SIZE
—First control circuit closes; Stops slow feed, starts fine feed.

FINAL SIZE REACHED
—Second control circuit closes. Wheelbase retracts.

LANDIS TOOL COMPANY / WAYNESBORO, PENNA.

A Great Seller

...because it's a Comfortable Eye-Protector!

AO F-9200 Acetate Goggle

When we brought it out, we were sure there was a great future ahead for this goggle of non-flammable cellulose acetate butyrate—but its popularity has surprised even ourselves! Here are its features that workers appreciate:

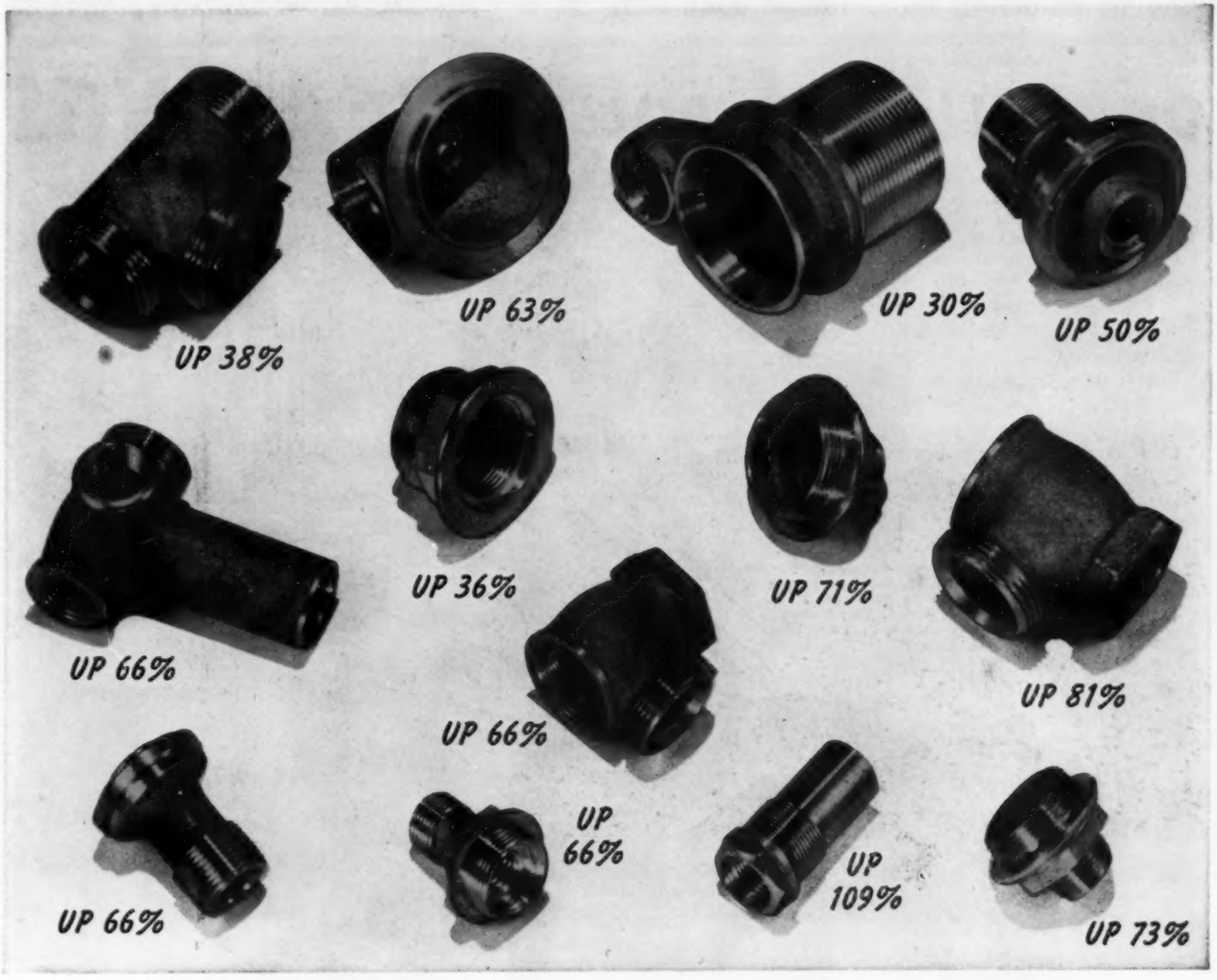
1. ASSURED PROTECTION.
2. Hinges and temples out of line of sight.
3. Smarter appearance.
4. Lenses that conform to and cover eye orbit.
5. Improved fit.
6. Comfortable, lightweight, face-formed bridge.
7. Nosepads which distribute goggle weight *evenly.*

This goggle does a prime protection job on operations in chemical and electrical plants where the tiniest spark might cause fire or explosion. Because of its acetate construction it is especially recommended for these and similar jobs where metal goggles might not be recommended. Available with ventilated side shields for added safety against lateral-striking objects. Lenses are 6-Curve Super Armorplate. When protection from glare, ultraviolet or infra-red radiations is a "must", specify Calobar lenses. For a handy source of supply, see the AO representative. There is always one near you.

Safety Division of American Optical COMPANY

SOUTHBRIDGE, MASSACHUSETTS • BRANCHES IN PRINCIPAL CITIES

Do you make brass parts like these?



Electro-Cycle TRADE MARK makes them 52% faster

● When an efficient plant in the highly competitive brass industry can increase production of the parts shown above by 52%, *that's news!*

Six new Warner & Swasey Electro-Cycle Turret Lathes, replacing six cone head machines, did just that. These new Electro-Cycles, with their instantaneous automatic spindle action, are making records just as remarkable in many other brass shops across the country. Hadn't you better find out what they can do for you?

WARNER & SWASEY
Cleveland

You Can Machine it Better, Faster, for Less.. with a Warner & Swasey

TURRET LATHES, MULTIPLE & SINGLE SPINDLE AUTOMATICS, PRECISION TAPPING AND THREADING MACHINES

LINK-BELT—A GOOD NAME ON BALL AND ROLLER BEARINGS

A *good name* is one of man's proudest possessions. A *good name* is also a manufacturer's requisite to stay in business.

For three-quarters of a century, the name "LINK-BELT" has warranted the respect of industry. When you see that name on bearings, you can be sure that the quality is RIGHT. And once you use Link-Belt Bearings, you'll add *your good name* to the names of others who agree that Link-Belt is definitely a *good name* on ball and roller bearings.

LINK-BELT COMPANY

Indianapolis 6, Chicago 9, Philadelphia 40, Pittsburgh 19, Atlanta, Dallas, Cleveland 13, Minneapolis 5, San Francisco 24, Houston 2, Los Angeles 33, Seattle 4, Toronto 8. Offices, Factory Branch Stores and Distributors in Principal Cities

L2101

Long life

Inbuilt alignment

Neat appearance

Keen craftsmanship

—

Best performance

Efficient operation

Low cost

Time-tested

THE SYMBOL OF QUALITY · LINK-BELT · LB

Send for Catalogs

A COMPLETE LINE OF MOUNTED AND UNMOUNTED BALL AND ROLLER BEARINGS

LINK-BELT BALL AND ROLLER BEARINGS

8 SPINDLES . . .
32 TOOLS
What's the answer?

MODERN-MAGIC
CHUCK AND COLLET EQUIPMENT

The above set-up is a typical example of what can be done with MODERN Magic Quick Change Chuck and Collet equipment. Here, four spindles of the machine, equipped with MODERN Magic Chucks, perform twenty-eight separate operations.

The twenty-eight tools are easily and quickly changed without stopping or even slowing the machine. Bulletin M-101 gives complete details on MODERN Magic Quick Change Chuck and Collet equipment. Send for your copy today.

PROMPT SHIPMENT . . . USUALLY MADE FROM STOCK

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MODERN TOOL WORKS

DIVISION OF
CONSOLIDATED MACHINE TOOL CORPORATION
ROCHESTER 10, NEW YORK

YOU CAN GRIND FOR LESS

When You're Using the *Right* Wheel on Each Job

And it's easy to use the *right* grinding wheel—the economical wheel—when you're buying Norton. Here's why:

1. ***The completeness of the Norton line***—The wide variety of types of Norton wheels, the many abrasives and bonds, the wide range of grains, grades and structures—they make it possible to provide a wheel with the correct grinding action for ***each job*** in your plant.

2. ***The country-wide Norton engineering service***—It's not enough to have the right wheels—they must be correctly selected for your grinding jobs. There are Norton abrasive engineers in every industrial center—highly skilled men who know how to solve your grinding problems. Back of them is the Worcester staff with its experts in various types of grinding. And supplementing the Norton field force are the abrasive specialists of Norton distributors—men who have been factory-trained at Worcester so that they really know grinding wheels.

Let a Norton engineer or a distributor's specialist select from the complete Norton line the *right* wheel for each of your grinding jobs. *You'll find that you really can grind for less.*

NORTON COMPANY, WORCESTER 6, MASS.

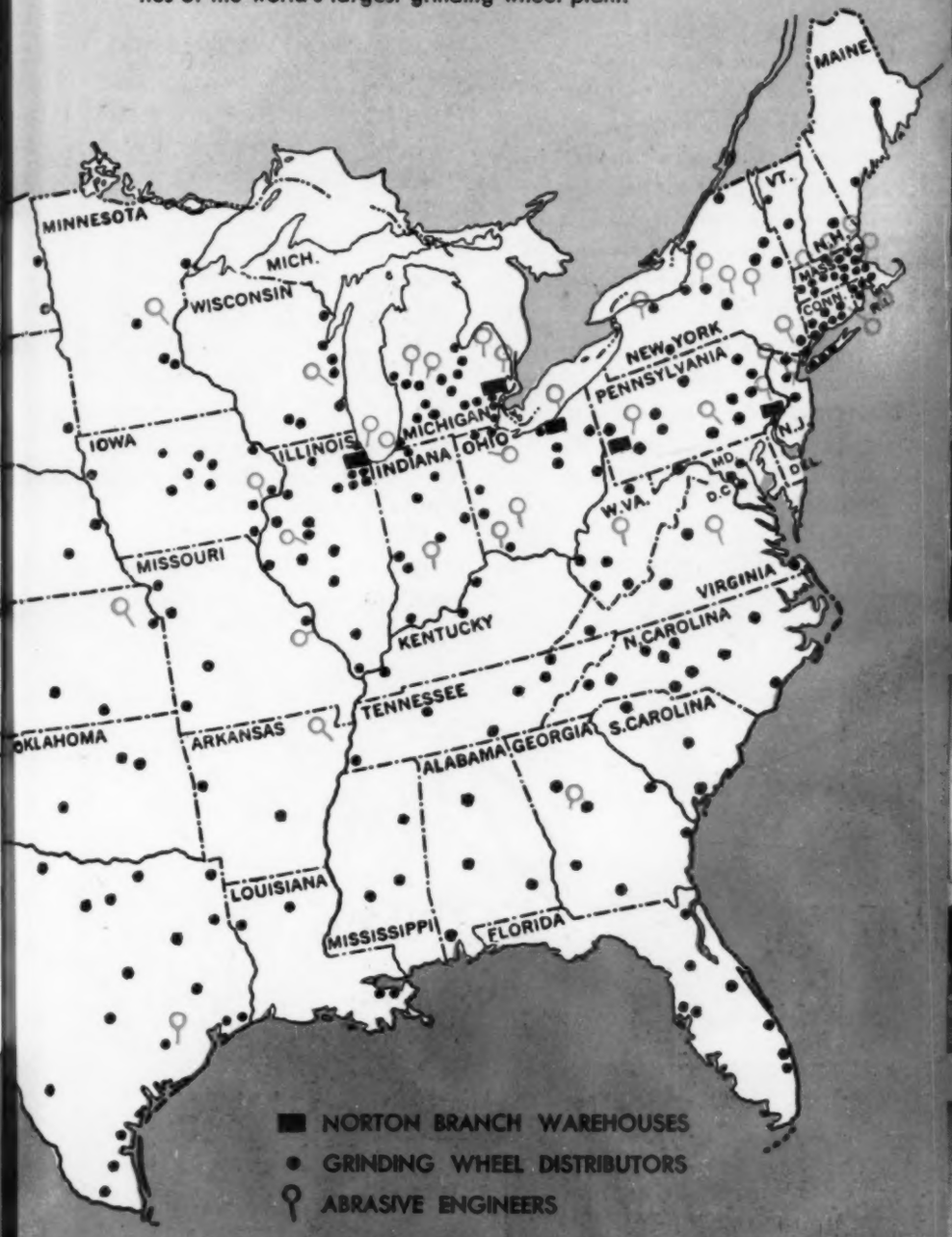
NORTON GRINDING WHEELS

Are Handy to You

In over 200 cities from coast to coast there are Norton distributors with grinding wheels on their shelves—many with thousands of wheels.

Back of them in five strategic locations, are the Norton warehouses illustrated at the right—staffed and stocked for prompt service.

And back of them there's the Norton factory stock at Worcester of over 3,000,000 grinding wheels—backed in turn by the manufacturing facilities of the world's largest grinding wheel plant.



NORTON ABRASIVES

NORTON WAREHOUSES

CHICAGO

CLEVELAND

PHILADELPHIA

DETROIT

PITTSBURGH

This newest Worcester unit, with a floor space of nearly five acres, is just about complete and the installation of machinery and equipment has started. When it goes into operation it will still further increase Norton grinding wheel production facilities.

The CONE AUTOMATIC MACHINE COMPANY sees many GOOD THINGS AHEAD

It is reported that . . . . . .

National Bureau of Standards has a new magnetic clutch, which is intended primarily for immediate use in servo mechanisms, but has possibilities in many fields including the automotive. It consists of a driving and a driven plate immersed in oil, in which are suspended iron particles that can be magnetized or demagnetized.

get ready with CONE for tomorrow

Carnauba wax now has a rival in a substance extracted from Mexican sisal fiber, according to Armour Research Foundation.

be ready with CONE for today

Dow Chemical Co. has found a way to electroplate magnesium by first coating the metal with zinc.

get ready with CONE for tomorrow

Standard Railway Equipment Mfg. Co. has perfected a machine for truing car wheels without removing them from the trucks.

be ready with CONE for today

Greyhound Corporation's new 50-passenger, two-level bus has a crash-proof gas tank made by Firestone Tire & Rubber Co.

get ready with CONE for tomorrow

Electronic vulcanization has become a standard production process at B. F. Goodrich Co.

be ready with CONE for today

Lustron Corp. of Columbus, Ohio, has a porcelain enameled steel prefabricated house which they expect to be producing at the rate of 3700 units per month by next October.

get ready with CONE for tomorrow

Ford's light car will be made and sold in France.

Beech Aircraft Co. promises a new automobile with air-cooled engine and electric drive to all four wheels.

be ready with CONE for today

The first Conomatic multiple spindle lathe was built to accommodate carbide tipped tools almost two decades ago. The exclusive frame design of the machine remains practically unchanged today.

get ready with CONE for tomorrow

"Durisol" is the name of a new building panel made of wood shavings and portland cement by Durisol, Inc., 420 Lexington Ave., New York City.

Allis-Chalmer's new low-priced tractor pushes the tools instead of pulling them so that the farmer can see his work.

be ready with CONE for today

B. F. Goodrich Co. has announced that some of its extruded shapes are being vulcanized electronically. Time has been cut in some cases from 1½ hours to two minutes.

get ready with CONE for tomorrow

E. I. duPont de Nemours & Co. has granted licenses to 50 paint manufacturers to make its metallic lacquer finish.

be ready with CONE for today

The new Oldsmobile engines will have a compression ratio of nearly 8 to 1.

get ready with CONE for tomorrow

Kaiser-Frazer Co. announce that they are experimenting with magnesium automobile wheels.

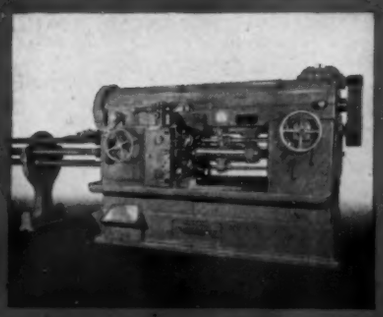
FOLLOW THESE PAGES FOR NEWS OF PROGRESSIVE PRODUCTION

Profitably

CONOMATIC

TWO of these ball-bearing inner races are turned from SAE 52100 tubing, 2⅛" O.D., 1½" I.D., in 11 seconds on the 6-spindle Conomatic.

Ask your CONE *representative to show you our new color motion picture*



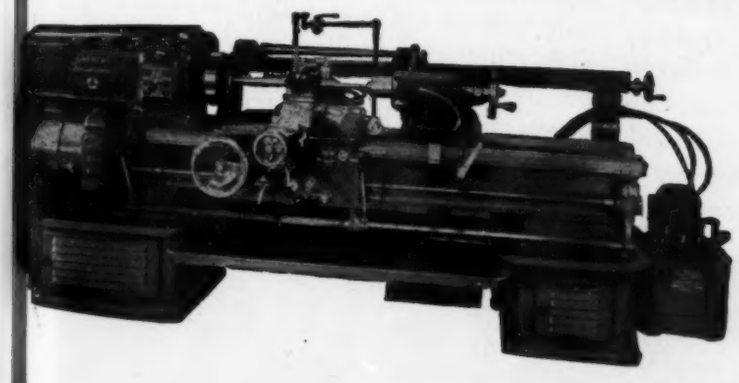
CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U.S.A.

52

SHAFT PRODUCTION COSTS

CUT TO THE BONE...



The new "American" "H S-D" (Hydraulic Shaft-Duplicating) Lathe presents to the metal-working industry a new and revolutionary technique for the production of various types of shafts. Other methods are now outmoded by this new development. Production costs have hit a new low. Piston rods that formerly took over 4 hours are now produced on this lathe in 36 minutes.

• **Write for descriptive literature—Bulletin No. 35**

THE AMERICAN TOOL WORKS CO.

Cincinnati, Ohio, U. S. A.

Lathes and Radial Drills

A BUYING GUIDE FOR ABRASIVES

ABRASIVE PROBLEM:
Where is there a convenient Source of Supply?

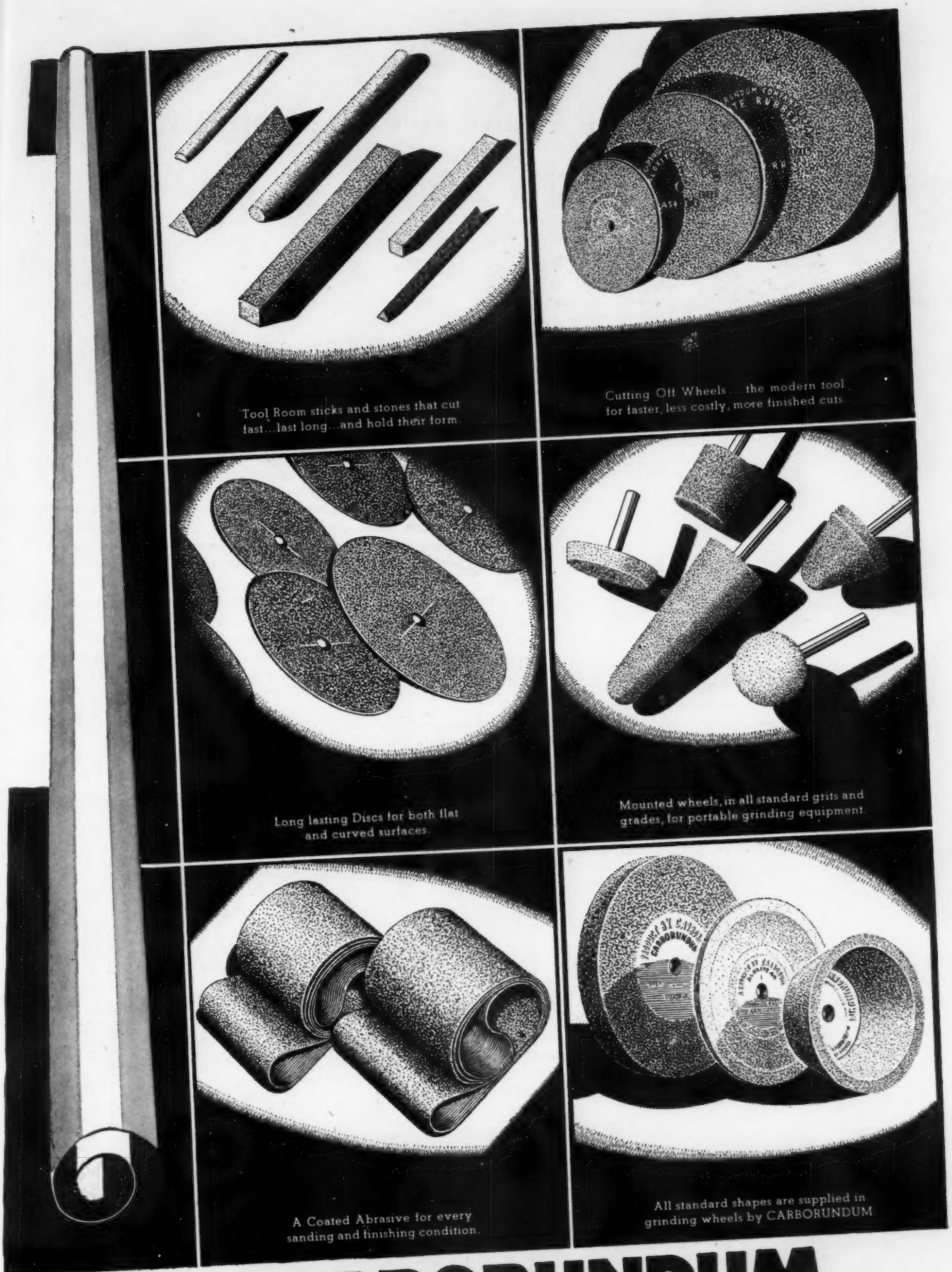
ANSWER BY
CARBORUNDUM
TRADE MARK

As an efficient and dependable source of supply, the services and facilities of your CARBORUNDUM distributor offer time and money saving advantages.

From large and varied stocks of abrasives located conveniently nearby, the products you need are available without delay. Plant inventories can be safely and economically reduced. Frequent personal service by a trained and experienced local staff provides reliable facts and figures on abrasive applications and operations. On difficult or unusual jobs, direct assistance from CARBORUNDUM representatives is available.

Simplified buying and other important savings realized from intelligent and efficient handling are creating an increasing preference for abrasives by CARBORUNDUM. The Carborundum Company, Niagara Falls, New York.

A Good Rule for Good Grinding

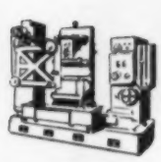

Tool Room sticks and stones that cut fast...last long...and hold their form.
Cutting Off Wheels... the modern tool for faster, less costly, more finished cuts.
Long lasting Discs for both flat and curved surfaces.
Mounted wheels, in all standard grits and grades, for portable grinding equipment.
A Coated Abrasive for every sanding and finishing condition.
All standard shapes are supplied in grinding wheels by CARBORUNDUM

... CALL IN **CARBORUNDUM**
TRADE MARK

● BONDED ABRASIVES ● COATED ABRASIVES ● ABRASIVE GRAINS AND COMPOUNDS

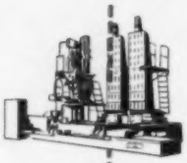
A message

to "the men who make dreams come true"



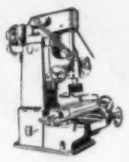
P&W Automatic Duplicator

P&W Die Sinker



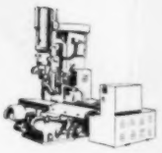
P&W Keller Machine

P&W Vertical Shaper

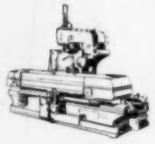


P&W Jig Borer

P&W Kellerflex



P&W Jig Grinder

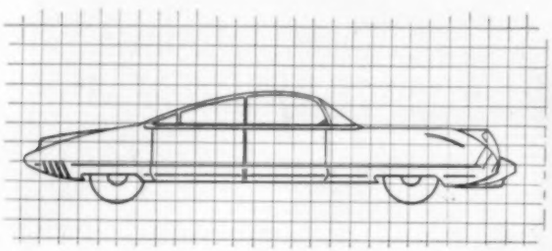


P&W Surface Grinder

Whatever dies and molds your dreams require for transmutation . . . Pratt & Whitney can supply what it takes to make them

It's our job to know how to build the kind of precision machine tools you need in your business. Our experience and products are the source for the tools, dies and molds needed to produce your products. Designs no longer need to be hampered by die limitations if your shop is Pratt & Whitney equipped. No matter what tooling problem you have, there is Pratt & Whitney equipment that will make it. Smart shop executives plan their replacement and expansion programs around this equipment. Pratt & Whitney precision pays dividends and cuts costs by the coordinated performance of tools and machines made to work together. Literature is available for the asking.

In 1946 the A.S.T.E. used this slogan as the Cleveland Show keynote . . . to describe the American Tool Engineer.



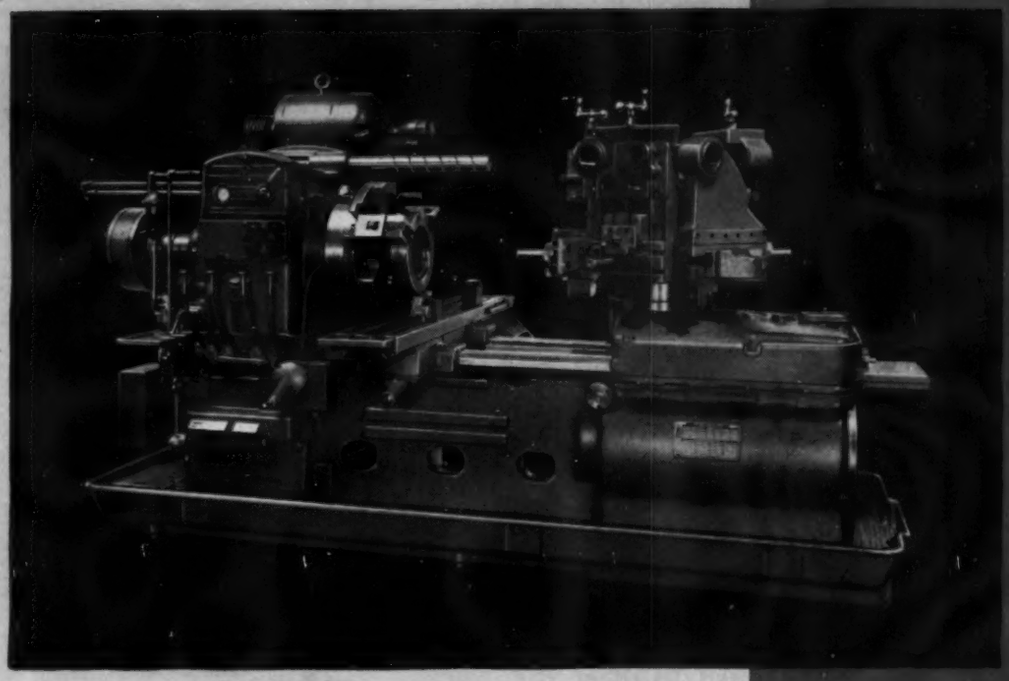
Even more than today, the car of tomorrow will be a product of better dies and molds. Increased knowledge of die design . . . improved coordinated tools by Pratt & Whitney . . . these make it possible to convert into metal and *mass produce* almost anything a designer can dream.

PRATT & WHITNEY
Division Niles-Bement-Pond Company
West Hartford 1, Conn.

"There is no better-paying investment than the right tools for the job"

Pratt & Whitney
Die- and Mold-Making Equipment

Futuristic car, courtesy THE IRON AGE



6DRE

Advanced features...of the P&J 6DRE AUTOMATIC TURRET LATHE *contribute to lower cost production . . . of large duplicate parts*

The 6DRE series of automatic turret lathes are designed with the power, rigidity and control convenience to enable them to handle the production of large parts economically. Versatility in tooling, characteristic of all P&J machines, makes them adaptable to a wide range of work.

These machines are provided with 4 automatic changes of spindle speed, 3 selective automatic changes of feed and automatic binding of turret after indexing. Other features are direct slide action, and a motor driven constant rapid traverse motion to cross slide and turret slide.

P&J Methods Engineers are available to assist you in taking advantage of the production possibilities of this and other machines in the P&J line to cut your costs of machining duplicate parts.

For more complete information send for catalogue 1a/25a.

CONDENSED SPECIFICATIONS

	6DRE	6DREL	6DRELX
Swing over bed	34"	34"	34"
Cross Slide Travel (each way)	8½"	8½"	6¼"
Turret Faces	5	5	6
Turret Slide Travel	18"	25"	28"

OTHER P&J AUTOMATIC TURRET LATHES

Model 3U—(Swing over cross slide: 9½")
Model 4D—(Swing over bed: 21")
Model 5D—(Swing over bed: 25")
Model 5D-2—(2-spindle Swing Limited by Spindle to Spindle Center Line Distance 10½"-15½")
Model 6DS—(Swing over bed: 34" and 40")
Model 8DT—(Swing over bed: 36")

POTTER & JOHNSTON COMPANY
PAWTUCKET, RHODE ISLAND
Subsidiary of
Pratt & Whitney
division Niles-Bement-Pond Company

ARMSTRONG

ARMALOY

Drop Forged

WRENCHES

ARMSTRONG ARMALOY — Wrenches are NEW. They are designed to meet the requirements of the mechanic who knows his tools and insists on using tools of Superior Quality.

ARMSTRONG ARMALOY — Wrenches are made from selected grade alloy steel. They are longer, lighter, thinner, yet stronger than the conventional alloy wrenches—heat treated to exact specifications of stiffness and tensile strength—better balanced, hence easier to use. Finished in chrome plate with heads buffed bright.

Armstrong Tools are stocked by leading tool departments.

Combination

Box Socket

Construction and Structural

Hex Box

Reversible Ratchets

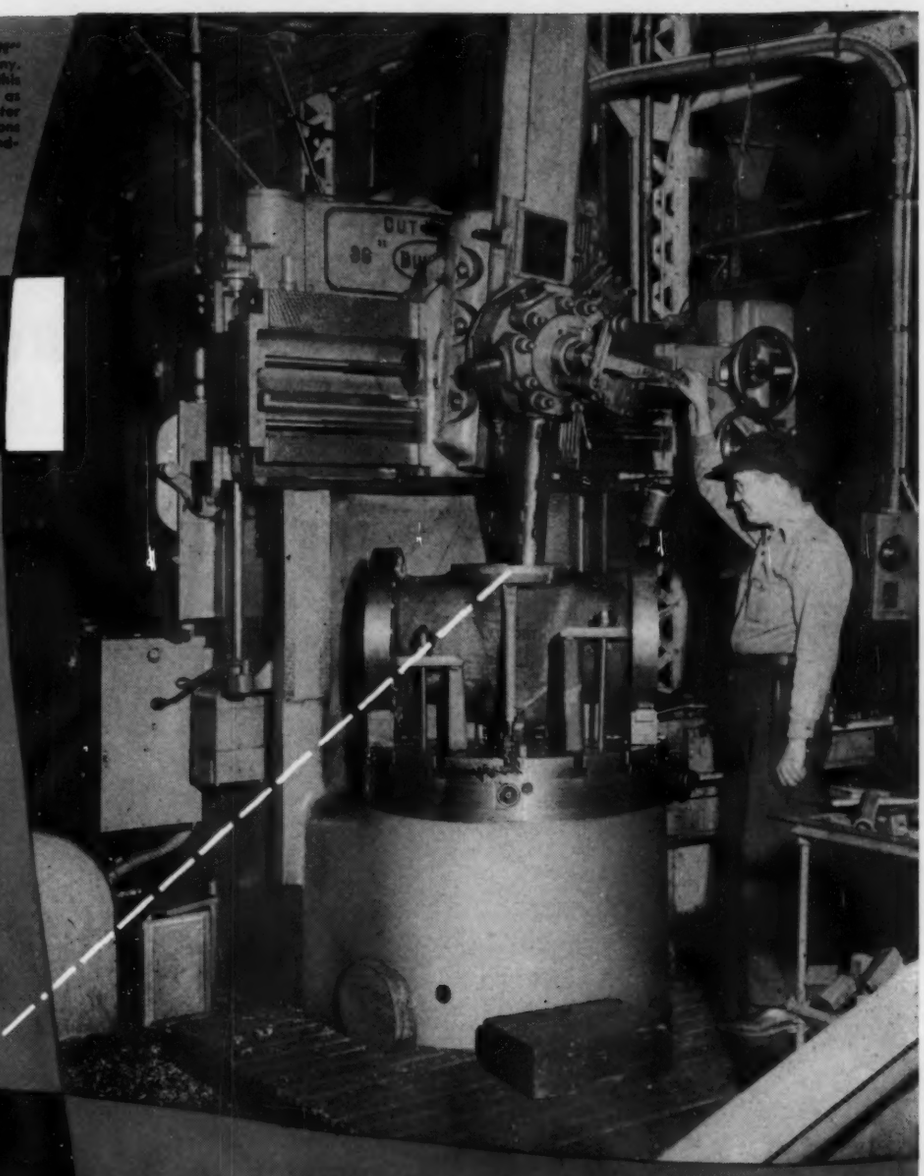
Detachable Sockets and Sets

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People."

5215 W. Armstrong Ave. Chicago 30, Ill.

This BULLARD 36" Cut Master is "really paying off" at Newport News Shipbuilding & Drydock Company. Here you see it taper boring a large valve. On this job, it also faces the flange and counter bores, as shown on the cross-sectional drawing. The Cut Master not only saved 33⅓% on these three operations but also provided such a smooth finish that a grinding operation was eliminated.

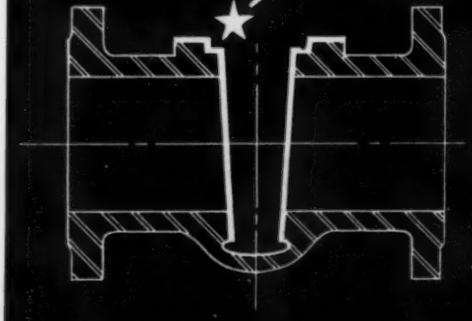


PERFORMANCE REPORT FROM NEWPORT NEWS SHIPBUILDING & DRYDOCK COMPANY

CUTS COSTS 2 WAYS ON CAST STEEL VALVES with a 36" BULLARD Cut Master

1. SAVED 33⅓% ON 3 OPERATIONS

2. ELIMINATED A GRINDING OPERATION



Cross sectional drawing of valve with heavy lines indicating machined surfaces.

You, too, can expect savings on most of your jobs. It's easy to see why: The bed is cast in one heavy, rigid piece. Spindle is firmly supported top and bottom by large Timken roller bearings. Screw feeds provide and maintain a high degree of machining accuracy.

OTHER COST-CUTTING ADVANTAGES

Because the BULLARD Cut Master was designed specifically to save time on and between cuts, you find other unique features. The rapid and positive speed selection with the BULLARD pendant type control, limit-stops for simplified dimensional duplication, and centralized operating controls speed up operations and conserve costs. For complete description of these and other distinctive features, as well as data on feeds, speeds and sizes, write for Bulletin CVTL-4-1 today.

THE BULLARD COMPANY, Bridgeport 2, Connecticut.

BULLARD

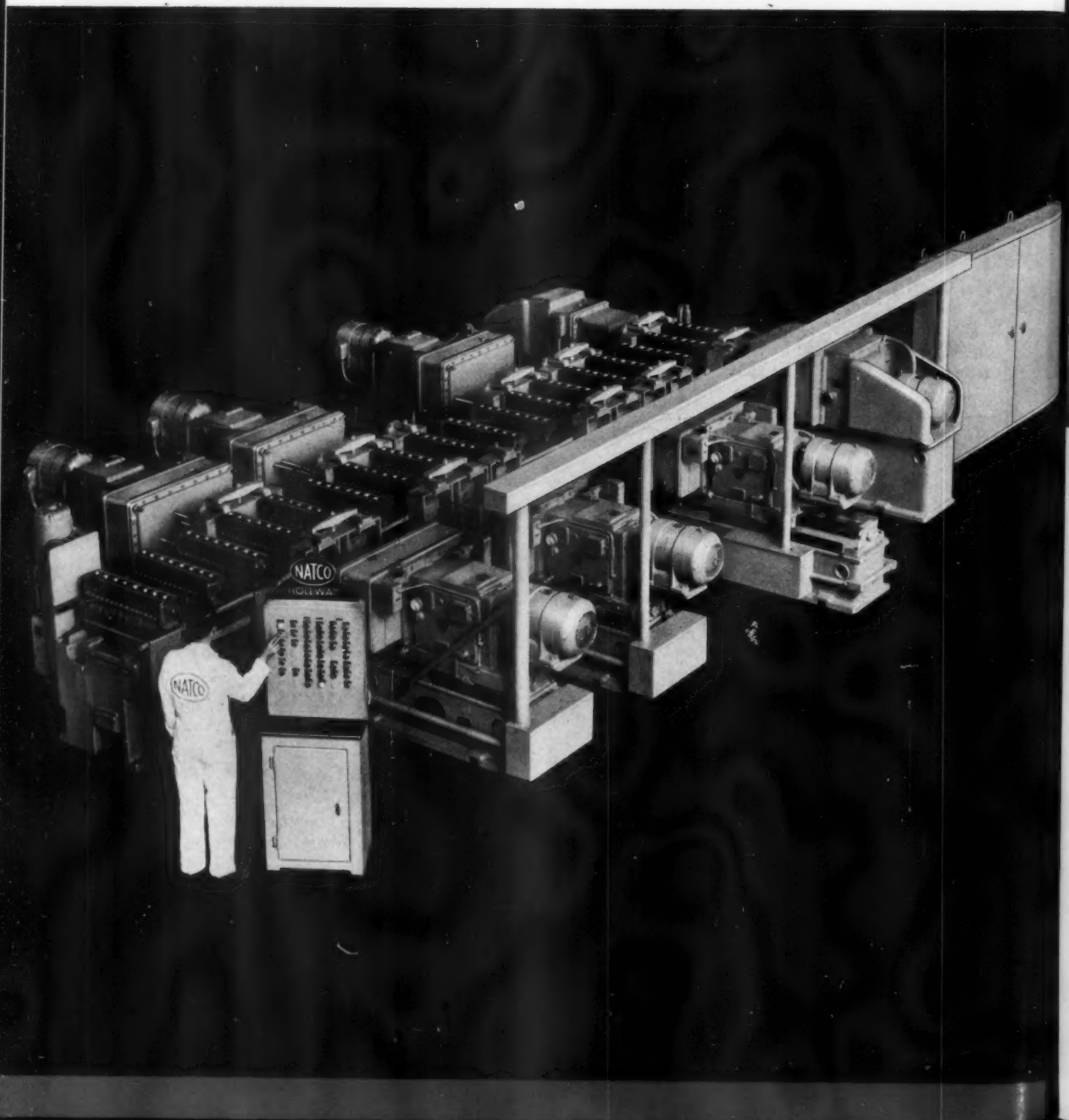
BULLARD CREATES *NEW METHODS* TO MAKE MACHINES DO MORE

NATCO

HOLEWAY Processing

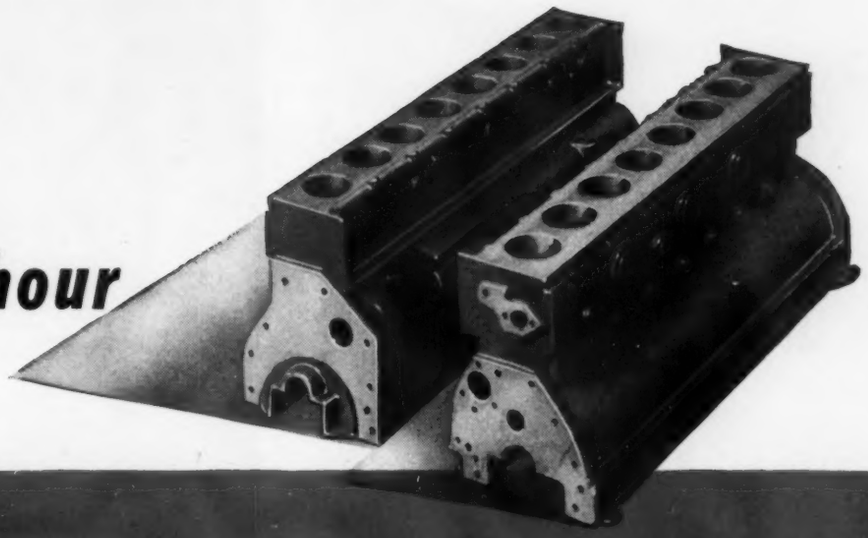
(Automatic Processing)

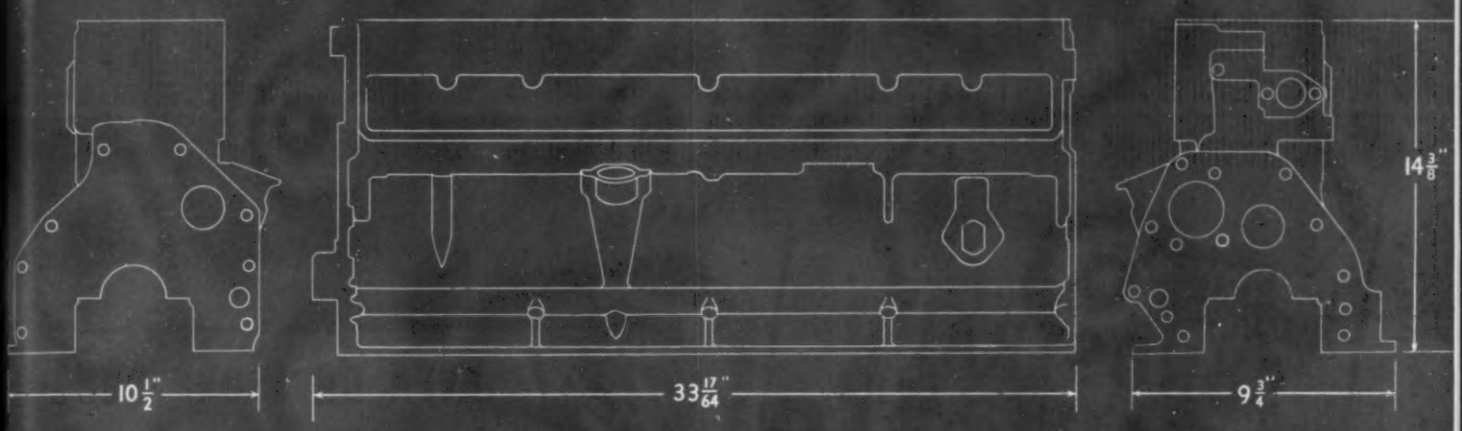
produces 90 engine



Machine

blocks per hour





The NATCO HOLEWAY Processing Machine illustrated at the left produces 90 engine blocks per hour with only one operator. It automatically advances the engine blocks from station to station, clamps and unclamps them in each position, and synchronously performs the operations at all stations as the blocks travel through the HOLEWAY Machine. The blocks are then automatically ejected onto a roller conveyor at the completion of all operations.

The NATCO HOLEWAY Machine illustrated here involves 19 stations and is arranged to complete the following operations: drills 23 holes ranging from 3/16" to ½"; combination drills and countersinks one 7/16" hole; countersinks 14 holes ranging from 3/16" to ½"; taps 15 holes ranging from ⅜" to 7/16" tap; drills 19/32" diameter oil gallery hole clear through engine block in 12 successive steps; taps oil gallery both ends ⅜" pipe tap.

Join the trend to automatic handling . . .

WRITE TODAY For New Illustrated Book!

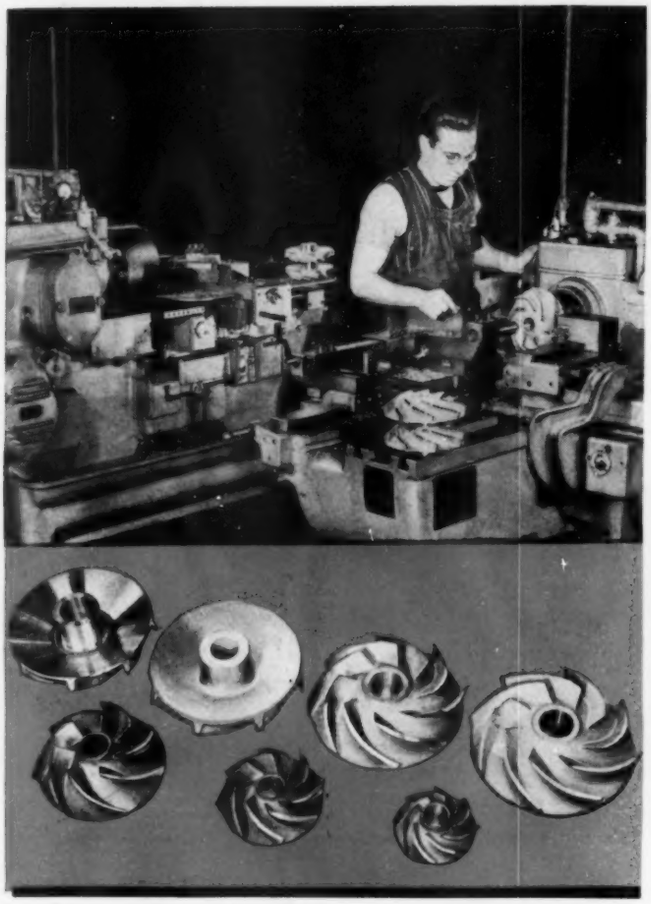
How NATCO automatic Processing Machines speed productive capacities of both machine and operator is described by actual case studies in a 28-page circular. It will pay you to write for one of these illustrated circulars to see how you can improve your automatic handling methods. Specify NATCO Machine Circular No. 145-A.

NATIONAL AUTOMATIC TOOL COMPANY, INC., RICHMOND, IND., U. S. A. • *Branch Offices:* **1809 Engineering Building, Chicago • 409 New Center Building, Detroit • 1807 Elmwood Avenue, Buffalo • 2902 Commerce Building, New York City**

YOU'LL GET BETTER PRODUCTION-LOWER TURNING COSTS WITH:

MULTIPLE TOOLING *PLUS* AUTOMATIC CYCLING

ON A SUNDSTRAND AUTOMATIC LATHE



Whether your turning problem is a mass production job running into thousands of pieces . . . a short run of as few as 25 pieces . . . or a special turning job, Sundstrand engineers will show you how it can be handled to advantage on automatic lathes with quick cycle changeover. They will also assist in designing the most profitable processing method for the job at hand.

All of the advantages of multiple tool turning are available for both short run and mass production work with Sundstrand lathes. When the nature of the work is such that these standard automatic lathes cannot be tooled to handle the part, our engineers recommend and design special automatic lathes.

Described here are three typical cases in which Sundstrand "Engineered Production" assisted plant engineers in designing a tooling method which resulted in lower turning costs.

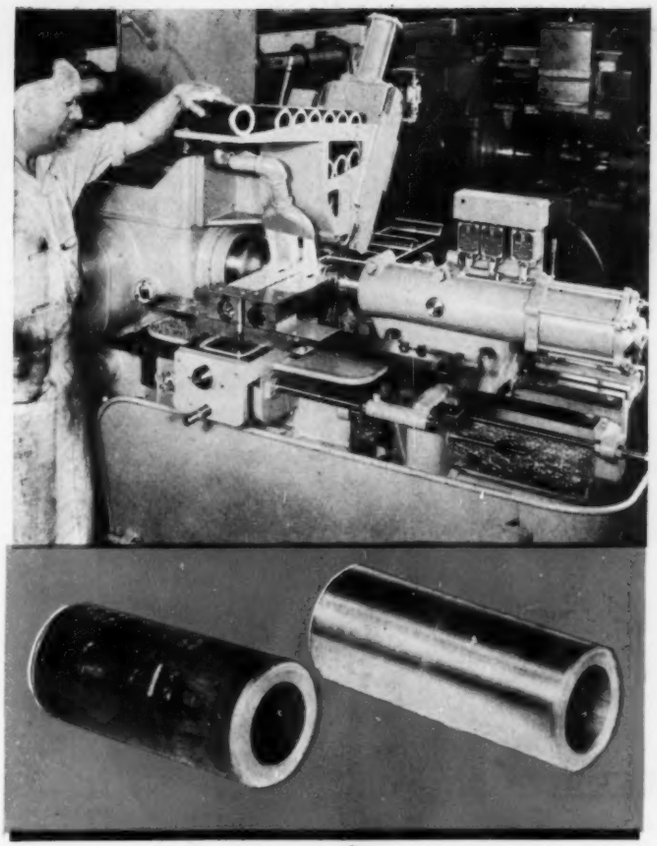
Yes! EVEN ON SHORT RUNS

Thirteen hours are saved on each lot of twenty impellers on this short run turning job. Parts are of bronze and used in deep well water pumps. They range in size from 4″ to 10″ in diameter.

In old method, parts were machined in three operations requiring three set-ups with special tooling in approximately fifteen hours. Now the same amount of machining is done in two set-ups on Sundstrand Model 10 Automatic Lathes in approximately two hours. The two Model 10 Automatic Lathes are equipped with special cam bars on front and rear tool slides for turning the convex and concave shapes on the impellers. A boring bar is provided for rough and finish boring the center hole. One operator runs both machines producing an average of nineteen completed parts per hour for each operation. Operator's duty consists primarily of loading, starting the automatic machine cycle and unloading after each cycle has been completed.

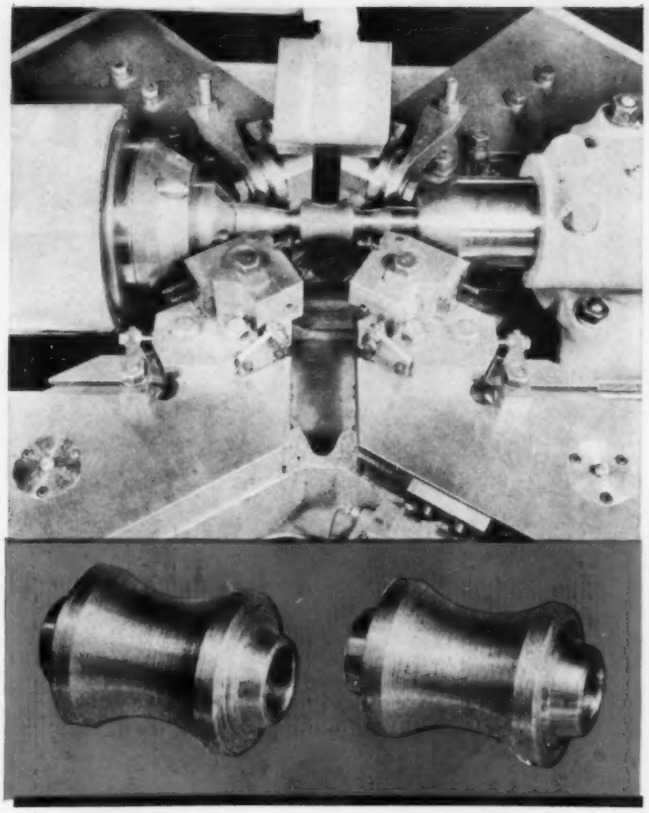
SUNDSTRAND MACHINE TOOL CO. ROCKFORD, ILLINOIS, U.S.A.

RIGIDMILS • FLUID-SCREW RIGIDMILS • AUTOMATIC LATHES • HYDRAULIC EQUIPMENT



Certainly! ON LONG RUNS

Automatic lathes have long been ideal machines for mass production turning. Combining an automatic cutting cycle with automatic loading and unloading makes this Sundstrand Model 10 Lathe completely self-operating. Several such machines can be easily attended by one operator, since his only duties are to keep the hopper filled with work parts. In this instance, the hopper-fed work part is a track-link bushing, 3″ dia. by 7-3/16″ long, weighing 8-3/4 lbs. The machine, with cam operated tool blocks on the front carriage slide, turns the O.D. and chamfers both ends. With a full hopper, the machine will run 12-1/2 minutes without further attention.



And SPECIAL TURNING

Some jobs when properly studied and analyzed indicate that they can be most profitably turned on a special lathe.

Here's a case in point:

Special Sundstrand lathe has four angular slides, simultaneously finish-forms cones and undercuts both ends of steering gear worm. Two angular front slides cross-feed for the undercut operation—while the two angular cross-feeding rear slides carry tool blocks and holders for the circular tools which finish-form the cones. The work is held on mandrels with spring loaded plunger-type driver. Production is approximately 90 pieces per hour.

MORE PROOF *Free*

This 44 page booklet, crammed full of technical data and production information, shows how to apply multiple tooling to countless turning jobs. Short-run, mass production and special turning jobs are all included. Write for your copy today. Ask for bulletin 173.

SUNDSTRAND
MACHINE TOOL COMPANY
2533 Eleventh St. • Rockford, Ill., U.S.A.

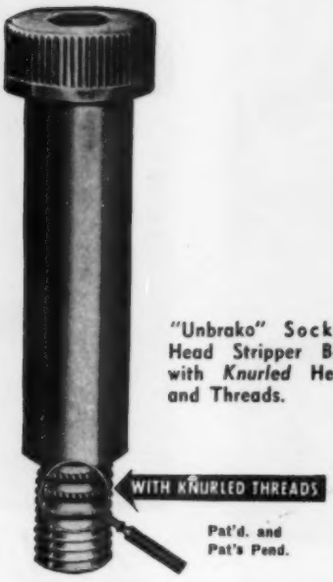
DRILLING AND CENTERING MACHINES • SPECIAL MILLING AND TURNING MACHINES

KNURLING

MAKES THEM SELF-LOCKERS

Pat'd and Pat's Pend.

"Unbrako" Socket Set Screw with *Knurled* Threads.



"Unbrako" Socket Head Stripper Bolt with *Knurled* Head and Threads.

Pat'd. and Pat's Pend.

Pat'd. and Pat's Pend.

"Unbrako" Socket Set Screw with *Knurled* Cup Point.

UNBRAKO SOCKET SCREW PRODUCTS

Reg. U. S. Pat. Off.

..."WON'T SHAKE LOOSE"

"Unbrako" Socket Screw Products are, of course, made of quality alloy steel. The "big point", of which we are justly proud, is our *exclusive* KNURLING feature, which is incorporated either on threads or points of "Unbrako" SET SCREWS . . . *and* upon the threads of our latest design Stripper Bolt, as illustrated. This KNURLING transforms them into excellent "Self-Lockers"—*essential* in Stripper Bolts subjected to repeated impacts.

Knurling of Socket Screws originated with "Unbrako" in 1934.

The Internal Wrenching feature of "Unbrako" Socket Screw Products results in weight-saving and compact designs. Sizes available from #4 to 1½" diameter, in a full range of lengths. Ask for your copy of the "Unbrako" Catalog . . . informative and useful.

Write us for the name and address of your nearest Industrial Distributor.

OVER 45 YEARS IN BUSINESS

STANDARD PRESSED STEEL CO.

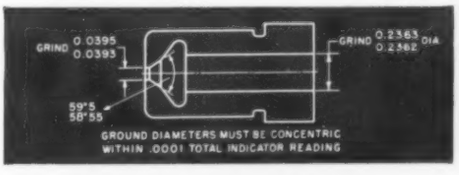
JENKINTOWN, PENNA. BOX 4

BRANCHES BOSTON CHICAGO DETROIT INDIANAPOLIS ST. LOUIS SAN FRANCISCO

What's in
VERMONT
this month?

SPECIAL MACHINE FINISH GRINDS INJECTION NOZZLE. Finishing fuel injection nozzles presents a unique group of internal grinding problems. The parts, as a rule, are small and demand extreme accuracy. There are three surfaces to be traverse ground and each one presents its own problem. First, the main bore, which is only .2363 inch in diameter has a seven to one ratio of diameter to length. Second, the tapered seat located at the bottom of this bore is to be traverse ground to an angular tolerance of one minute. Third, the .0394-inch hole, because of its extremely small size, demands grinding wheel speed far in excess of anything previously available. Fourth, a one-tenth concentricity is to be maintained on all three surfaces.

The Bryant Chucking Grinder Co. of Springfield, Vermont, has developed the No. 107-AW internal grinder for finishing injection nozzles at one chucking. Outstanding features include preloaded ball bearing slides for rigidity, an auxiliary angular slide for traverse grinding the tapered seat, Hi-Frequency wheelheads for speeds up to 100,000 r.p.m., and a precision workhead indexing from one wheel to the other to maintain con-


GRIND 0.0395 0.0393
GRIND 0.2363 0.2362 DIA
59°5 58°55
GROUND DIAMETERS MUST BE CONCENTRIC WITHIN .0001 TOTAL INDICATOR READING

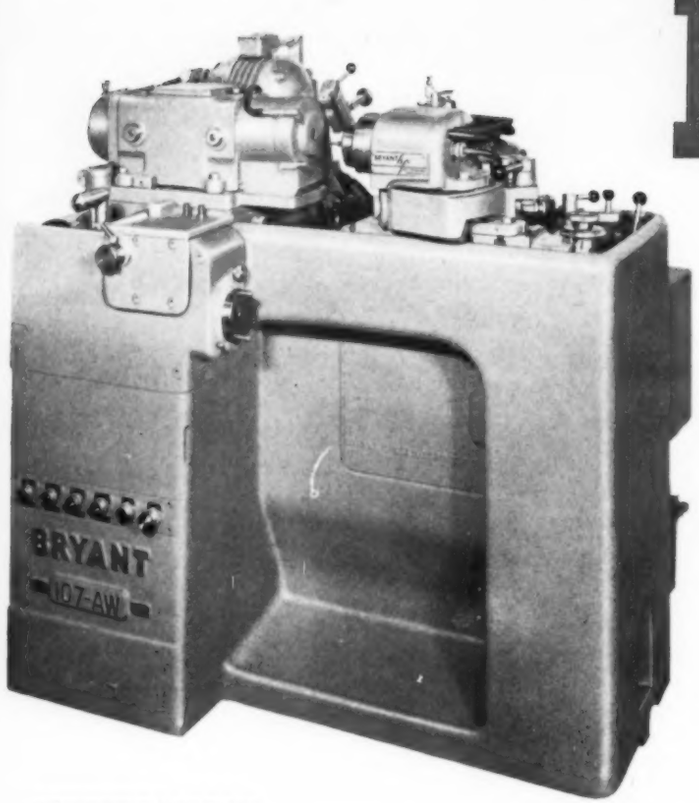
centricity. Some specifications for this machine may be found on the back of this page. For more complete information, arrangements will be made to show a 16 mm sound and color film on the No. 107-AW and other Bryant machines. . . . It won't cost to inquire.

Bryant Chucking Grinder Co., Springfield, Vermont, U.S.A.

BRYANT

Number 107-AW

INTERNAL GRINDER



The 107-AW is a standard machine for grinding two bores and an angular seat all on a common axis — see other side of page. Other Bryant equipment will grind holes through the complete range up to 60-inch diameter swing. Write to the factory for full information.

SPECIFICATIONS

Total swing	9 inches
Maximum traverse	6 inches
Maximum hole depth	3 inches
Angular slide adjustable from 25° to 45°	
R.P.M. of work spindle	up to 5,000 R.P.M.
Net weight	3,200 lbs.
Floor space — 60 inches x 50 inches (with coolant tank)	

SLIDES
Preloaded ball slides for cross, longitudinal and auxiliary angular motion.

WORKHEAD
Ball bearing spindle. Variable speed electric drive, to 5,000 R.P.M

WHEELHEADS (Two)
Ball bearing, Hi-Frequency, speeds up to 100,000 R.P.M.

TRAVERSE
Mechanical, powered by variable speed electric motor.

CROSS FEED
Powered by variable speed electric motor.

POWER
Standard A.C. current.

THE BRYANT SQUARENESS-OF-FACE GAGE not only shows acceptability of threaded parts, but also visually indicates the right angularity of the face with the pitch diameter of the thread. The squareness-of-face gage may be mounted on any Bryant bench gage.

You can *"See the Difference"* with a BRYANT GAGE

It is no longer necessary to "feel for fit" with plug and ring gages when inspecting threads. The Bryant Thread Gage shows, on a dial indicator, whether a thread will assemble properly with its component.

At a glance, anyone can compare threaded parts with a master and tell the whole story immediately — size, presence of burrs, out-of-roundness, accumulated inaccuracies of pitch, lead, diameter and thread form.

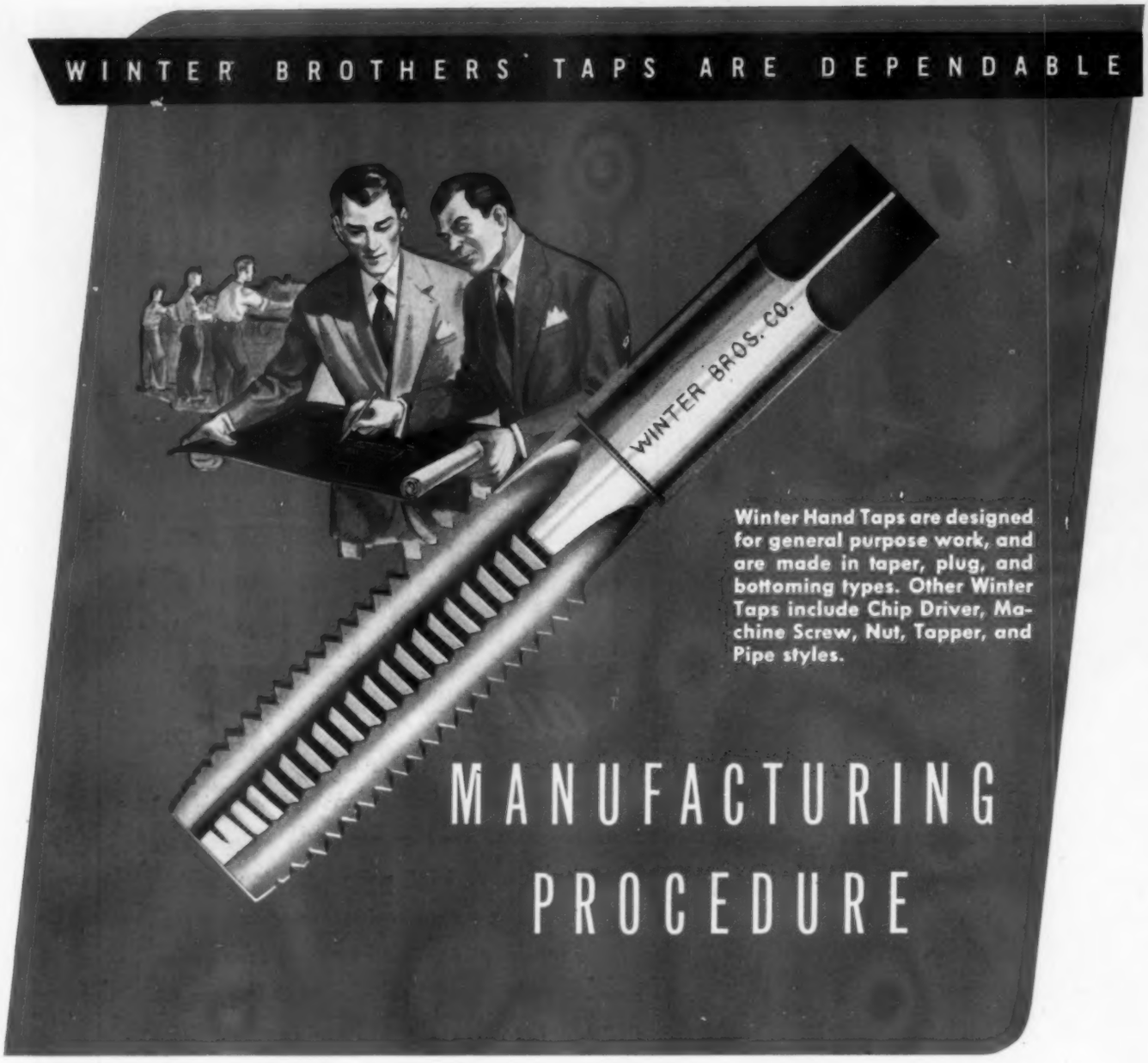
It's fast too. The design incorporates three thread segments, two stationary and one movable. The segments are operated by a thumb lever — the part is dropped between the segments — the lever is released, causing immediate contact of segments to threads — a one third turn of the part inspects it all over.

Send samples or drawings for a complete story on how Bryant can save inspection money for you.

Bryant Chucking Grinder Co., Springfield, Vermont, U.S.A.

NOW-
a water soluble coolant that's safe for automatic screw machines—
Houghton's new
ANTISEP
All-purpose Base
This versatile cutting base when mixed with water has remarkable lubricating properties. A 10% water dilution carries full load on a standard test machine. Also, it is inhibited against corrosive tendencies . . . won't rust bearings. Automatics of many types have been running on Antisep for a year without harm to machine parts.
Antisep A. P. Base can replace the dozen or more coolants you may now be using, at decided saving to you. For proof, write E. F. HOUGHTON & CO., Philadelphia 33, Pa.
ONE OIL THAT FILLS
90% OF YOUR CUTTING NEEDS!
A HUNDRED OILS . . . WRAPPED UP IN ONE!

WINTER BROTHERS TAPS ARE DEPENDABLE



Winter Hand Taps are designed for general purpose work, and are made in taper, plug, and bottoming types. Other Winter Taps include Chip Driver, Machine Screw, Nut, Tapper, and Pipe styles.

MANUFACTURING PROCEDURE

More than modern equipment and good materials are needed to make taps of Winter dependability. Equally critical is the ability to combine the various manufacturing steps into one efficient whole. Winter engineers have more than 47 years' experience in tool design and manufacture. This engineering knowledge, combined with the facilities of a new and modern plant, helps build dependability into Winter Taps and Dies.

Always at Your Service

YOUR LOCAL DISTRIBUTOR carries a complete stock of Winter Taps on his shelves—as close to your tapping problems as the telephone on your desk.

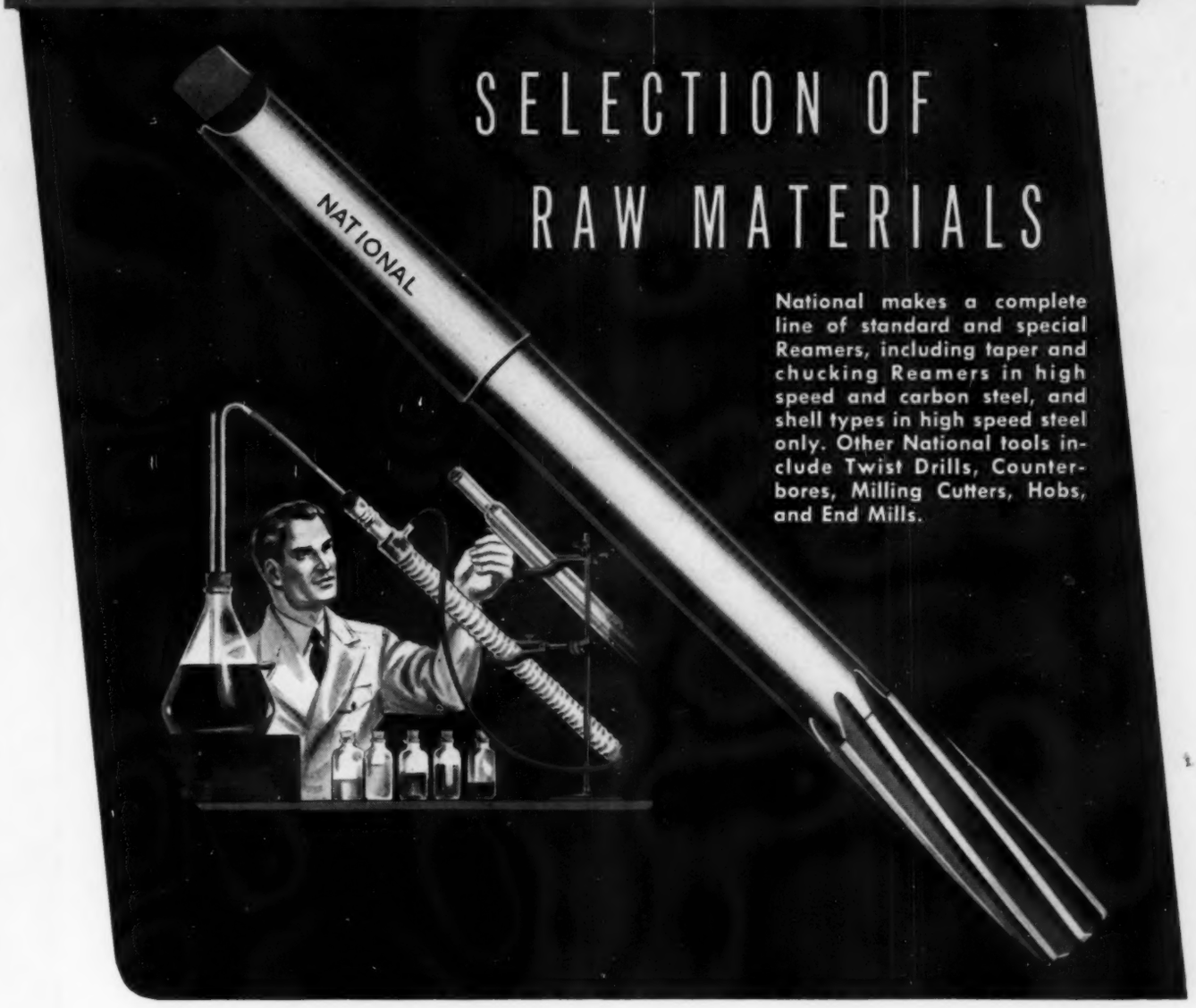
Winter Brothers COMPANY

ROCHESTER, MICHIGAN, U.S.A. • Distributors in Principal Cities • A Division of the National Twist Drill and Tool Company • Branch Stores: Detroit, Chicago, San Francisco

WINTER

PERFORMANCE IS BUILT INTO NATIONAL METAL CUTTING TOOLS

SELECTION OF RAW MATERIALS



National makes a complete line of standard and special Reamers, including taper and chucking Reamers in high speed and carbon steel, and shell types in high speed steel only. Other National tools include Twist Drills, Counterbores, Milling Cutters, Hobs, and End Mills.

Call Your Distributor

LEADING DISTRIBUTORS EVERYWHERE offer complete stocks of NATIONAL Cutting Tools. Call them for cutting tools or any other staple industrial product.

Every bit of steel that goes into National Cutting Tools is rigidly inspected and tested. At the same time, National conducts its own research into the properties of new steels as fast as they are developed. For example, the qualities of hardness and toughness, as related to tool life, are special subjects of National's raw material studies at all times. Methods like these build better performance into National Cutting Tools.

NATIONAL TWIST DRILL AND TOOL COMPANY

ROCHESTER, MICHIGAN, U. S. A. Tap and Die Division—Winter Bros. Co.

Distributors in Principal Cities • Factory Branches: New York • Chicago • Detroit • Cleveland • San Francisco

Is your cost-of-grinding going up?

Are your wheel-replacement costs, dressing costs and other grinding expenses climbing like a skyrocket—

While wheel-life, stock-removal and profits are coming *down?*

Make sure that your grinding isn't costing you more than it should. Call in a Peninsular engineer!

Your grinding—your methods, machines and materials—will be examined thoroughly, without obligation. Peninsular engineers will analyze their complete findings carefully, in the light of nearly sixty years of grinding experience.

Their suggestions will be based upon a thorough knowledge of your grinding problems, and the grinding wheels Peninsular engineers recommend to you will be individually engineered to your grinding jobs.

Call in a Peninsular engineer. It will mean lowered costs, higher production, bigger profits—we'll stake our reputation on it!

The Peninsular Grinding Wheel Co., 729 Meldrum Ave., Detroit 7. *Sales Offices:* Chicago, Philadelphia, Buffalo, Cleveland, Pittsburgh, Houston, St. Louis, Cincinnati.

PENINSULAR

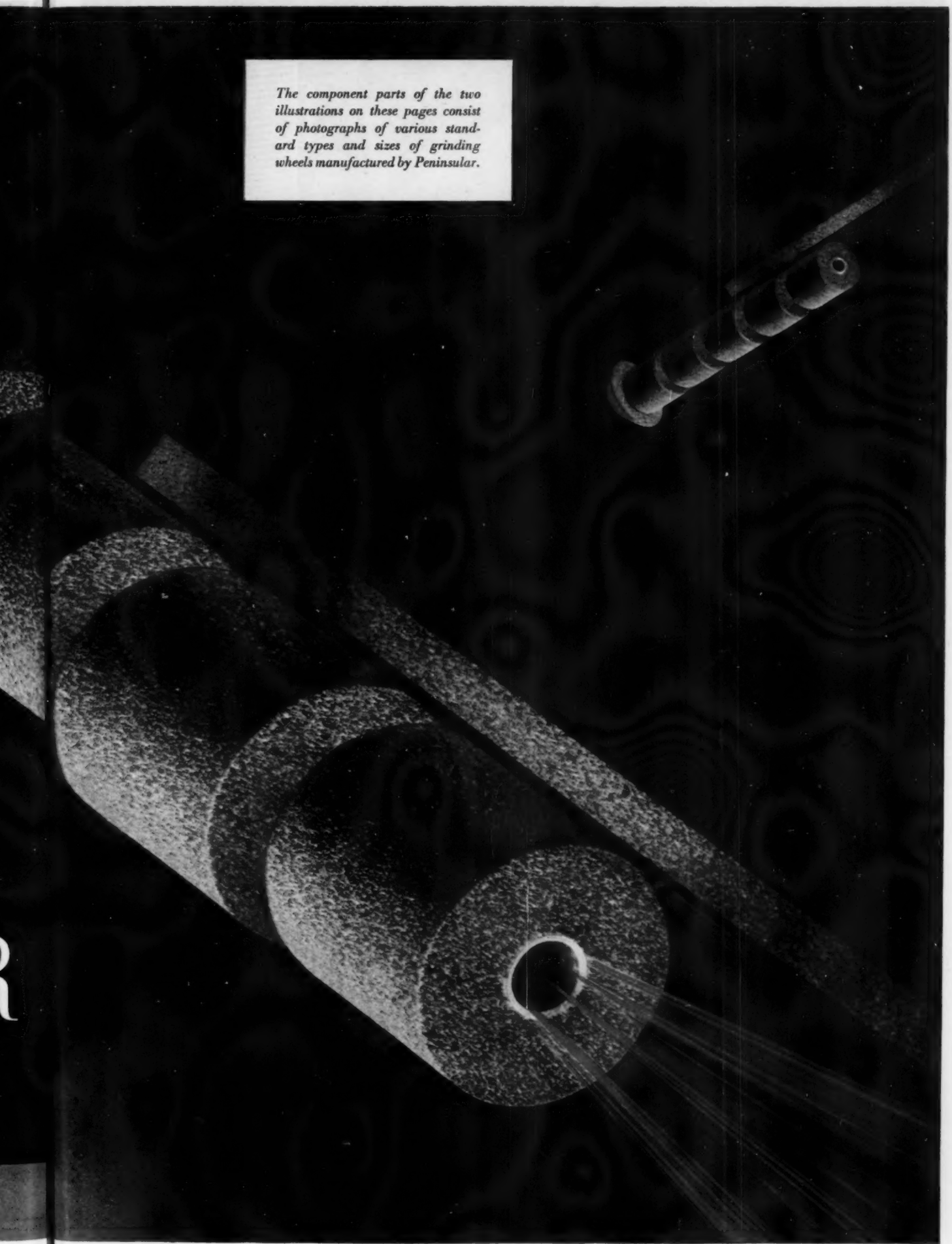
INDIVIDUALLY PENINSULAR *ENGINEERED*

GRINDING WHEELS

SINCE 1889

SPECIALISTS IN RESINOID BONDED WHEELS

The component parts of the two illustrations on these pages consist of photographs of various standard types and sizes of grinding wheels manufactured by Peninsular.



GRAY SPACE SAVER DRIVE....

Designed for double housing and open side planers the Gray Space Saver Drive (pat. app. for) gives these extra advantages:

- GRAY "Floating Shaft" eliminates usual flexible coupling with its noise and backlash, as well as wear on bearings caused by motor misalignment.
- Maximum load carrying capacity with enduring smoothness of motion.
- Fewer gears, shafts and bearings needed.
- Protects motor from dust and grit.
- Saves valuable floor space.

The G.A. GRAY Company

planers • milling planers
planer type milling machines
horizontal boring machines

CINCINNATI 7, OHIO, U. S. A.

SOLD IN CANADA BY UPTON, BRADEEN AND JAMES, LTD. • SOLD IN LATIN AMERICA BY MACHINE AFFILIATES

FURTHER PRODUCTION *increases*

with new BARBER-COLMAN "*MULTITHREAD*" Hobs

Where machine conditions are right, and tolerances are adaptable, Barber-Colman "*Multithread*" Hobs offer further increases in gear output from your existing hobbing machines.

For example, the job illustrated below was reduced from two operations to one cut by using "*Multithreads*". The machine's capacity for these large diameter hobs brought floor-to-floor production time down to 3.1 minutes per gear.

Best results with these hobs have been obtained on semi-finished gears, although they are used in some cases for finishing. The use of these hobs depends largely upon machine conditions, the amount of stock to be left for finishing and the characteristics of the particular gears to be cut.

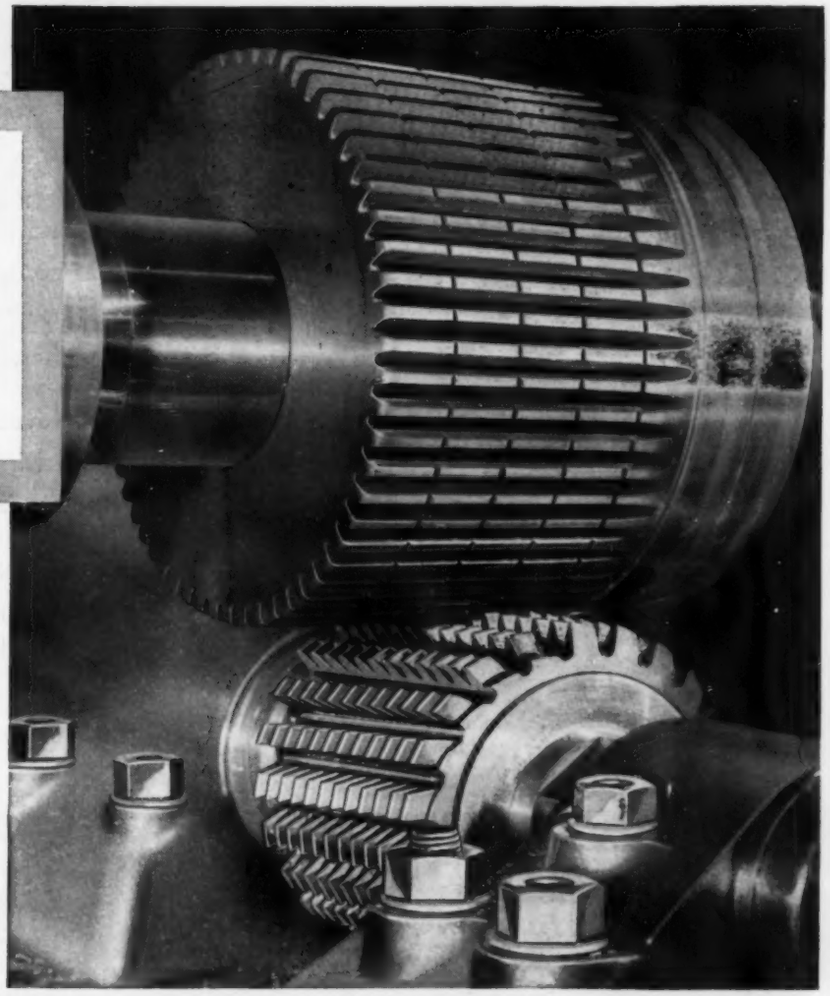
We are anxious to demonstrate what these new hobs will do, and we invite your questions and job requirements. Only on the basis of a comprehensive analysis of your job can we estimate accurately the possibilities for improvement with "*Multithreads*"

Barber-Colman Company

GENERAL OFFICES AND PLANT 110 LOOMIS ST., ROCKFORD, ILLINOIS, U.S.A.

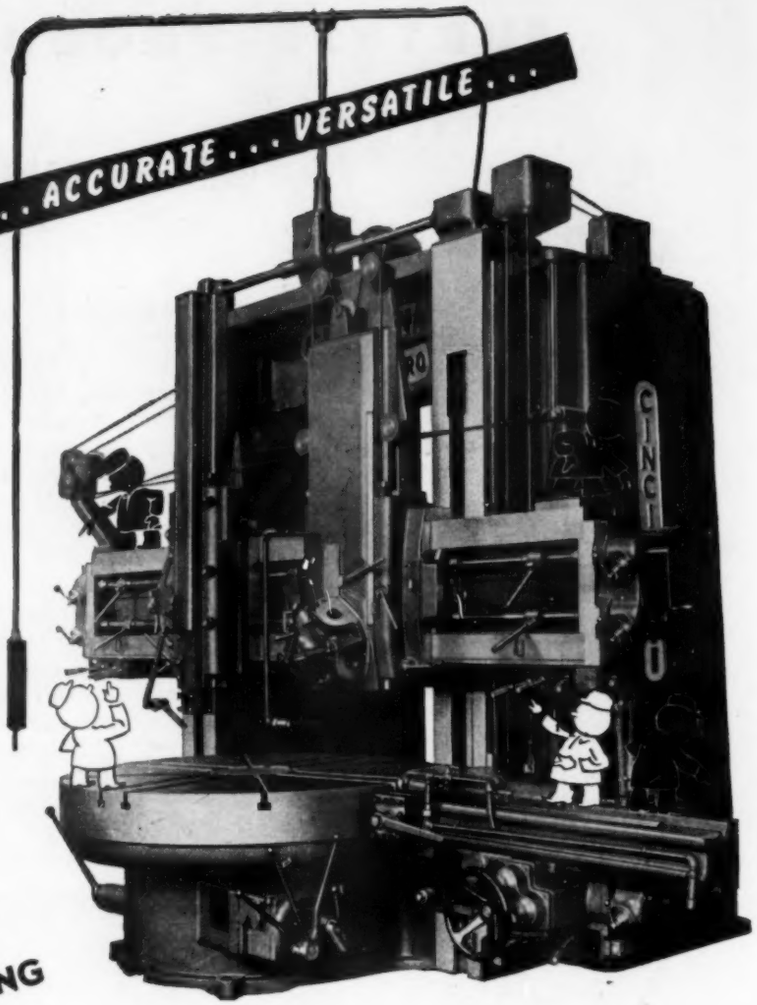
JOB FACTS

Operation — Climb Hob Precision Change Gears
Machine—Barber-Colman No. 14-15
Hob—Barber-Colman Ground "*Multithread*" Hobs
Material—NE 8949, 30-34 R.C.
Feed—.150"/rev. Speed—91 SFM
Floor-to-Floor Time—21.8 min. per load of 7
Hob Life—150 gears per sharpening
Accuracy—Adjacent spacing .0003"/.0005"



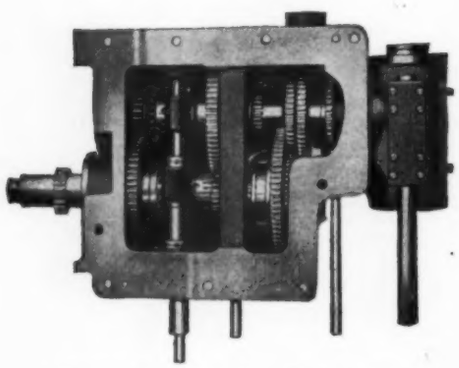
BARBER COLMAN — MODERN MACHINES DEMAND *Modern* CUTTING TOOLS

IT'S FAST . . . ACCURATE . . . VERSATILE . . .



The NEW and IMPROVED CINCINNATI HYPRO Boring Mill

FEATURING INDEPENDENT FEED, RAPID TRAVERSE AND REVERSING MECHANISM FOR EACH HEAD



Hypro Anti-Friction Power Feed and Traverse Box

An individual unit is provided for each Head and contains the complete power feed, rapid traverse, reversing mechanism and safety clutches.

All levers for feed, traverse and reverse are placed in front of the machine convenient to operator's working position.

Each box contains hardened alloy steel gearing mounted on multiple splined shafts and anti-friction bearings. Complete unit is enclosed and runs in a bath of oil supplied by a pump incorporated in the box.

THE CINCINNATI HYPRO PLANER COMPANY

PLANERS · BORING MILLS · PLANER TYPE MILLERS

CINCINNATI, OHIO

ARBON TOOL STEEL

The Toolmakers' First Choice

Some shop men have the impression that an expensive, high-alloy tool steel is the best choice for a new tool or die job. Not so! An experienced toolmaker automatically thinks first of carbon (or carbon-vanadium) tool steel. He may quickly reject this selection, but he does recognize that carbon tool steel is the logical place to start.

CARBON TOOL STEEL—THE GENERAL-PURPOSE GRADE

There are good reasons why water-hardening, carbon tool steels are selected for a wide range of tool and die jobs:

1. They are the easiest to machine of all tool steels.
2. They are easy to heat-treat.
3. They are not subject to excessive decarburization.
4. They develop keen cutting edges.
5. They provide high surface-hardness, with a tough core.

APPLICATIONS AND BETHLEHEM GRADES

Bethlehem X Carbon, with carbon content from 0.75 to 0.85 pct, is generally used for hand chisels and shock tools. Bethlehem XCL, XX, and XXX grades have several ranges of carbon content: 0.90 to 1.00 carbon for cold-heading die steels, 1.00 to 1.10 carbon for general-purpose tools and dies, and 1.15 to 1.25 carbon where keen cutting edges and more wear-resistance are needed for stone-dressing tools, drawing dies, paper knives, etc.

Bethlehem Carbon-Vanadium tool steel grades for similar applications are known as Best and Superior.

THE IMPORTANCE OF CONTROLLED HARDENABILITY

Bethlehem carbon grades have a hard outer case, reinforced by a tough, shock-resisting core—due to close control of hardenability in the steelmaking process. The controlled hardenability and spheroidized structure assure uniform results in heat-treatment. The easy machining structure of Bethlehem carbon tool steels is achieved by careful spheroidize-annealing in our modern furnaces. Our extensive metallurgical research has established the ideal degree of hardenability for a wide range of applications.

PROMPT DELIVERIES

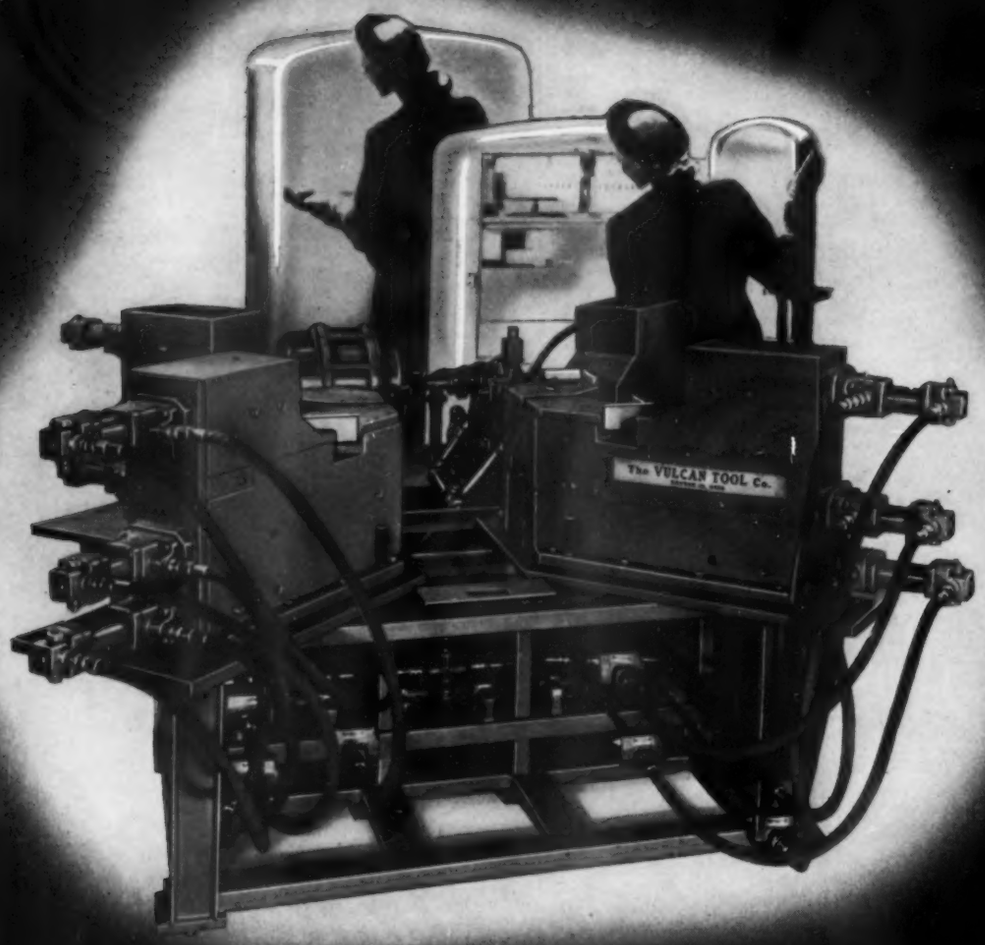
Bethlehem grades . . . carbon and a complete range of alloy tool steels . . . are delivered promptly, either from our mill depot or from your nearest Bethlehem tool steel distributor. Our technical staff is ready to work with you at any time.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor:
Bethlehem Steel Export Corporation

BETHLEHEM STEEL

CARBON . . . one of Bethlehem's Fine Tool Steels

4 CORNERS
formed every
7 SECONDS



Hydraulic Corner Forming Unit

speeds refrigerator food compartment liner production

Forms 4 corners simultaneously

Saves man hours

Saves floor space

For example, common practice was to blank and form one corner at a time, weld, and then metal finish. Dies were expensive, so was finishing department labor. With Vulcan's Hydraulic and electrically controlled Forming Unit all four (4) corners are formed at the same time every seven (7) seconds. One operator. No punch presses needed.

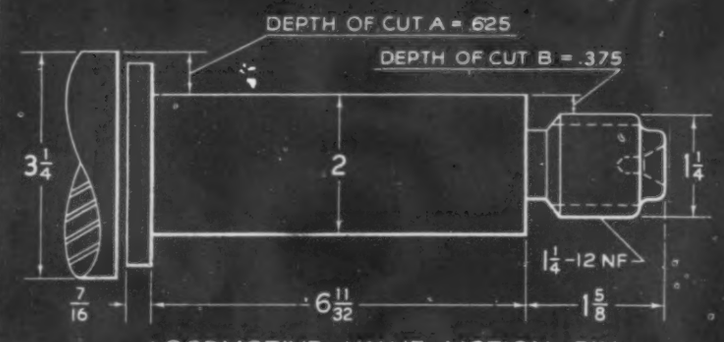
Let's talk about special tools and machinery for speeding your production. For better acquaintance ask for Vulcan Equipment List.

Vulcan Tool Co.
DAYTON 10, OHIO, U. S. A.
COMPLETE TOOLING PROGRAMS

YOU CAN CUT YOUR TURNING COSTS WITH JONES & LAMSON LATHES—

because

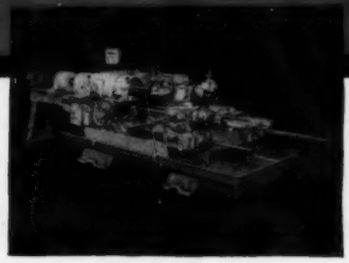
they have the Power, Rigidity and Spindle Speeds to use Carbide Tools effectively.



LOCOMOTIVE VALVE-MOTION PIN

Take this locomotive part for instance...

Another typical example of effective power turning with carbide tools on a Jones & Lamson No. 7A-5 Saddle Type Turret Lathe.
Cut "A" produces the 2" diameter from 3¼" X-1315 bar stock at 220 FPM and .022" Feed. The total power required approximates 22 HORSEPOWER! Turn "B" produces the 1¼" thread diameter at a surface speed of 275 FPM and .022" Feed. The total power requirement approximates 17 HORSEPOWER.
The complete valve motion pin is machined as shown, in 5.8 minutes floor-to-floor time—twice as fast as with high speed steel cutting tools.



YOU CANNOT COMPETE with production like this with machines less powerful, less rigid.
Jones & Lamson Lathes guarantee your investment.
***They anticipate* the future in metal turning.**
***They are built* with great reserves of ruggedness.**
***They are powered* to meet even more than today's requirements for the effective use of carbide tools.**
Let a Jones & Lamson engineer study your turning operations. He will be able to make recommendations that will improve your profit picture. He has for others.

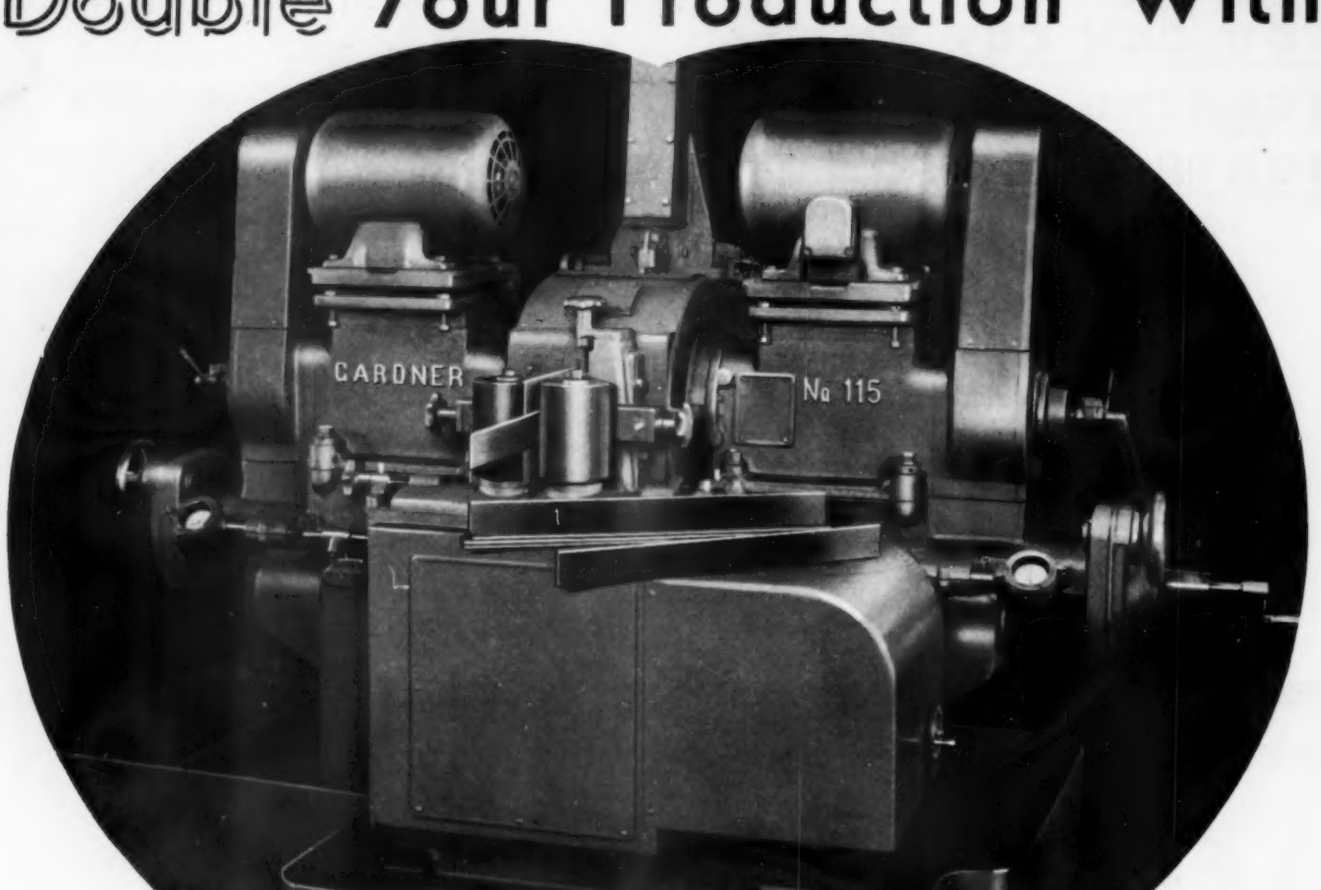
JONES & LAMSON MACHINE COMPANY, Springfield, Vermont, U. S. A.

Manufacturer of: Universal Turret Lathes · Fay Automatic Lathes · Automatic Double-End Milling and Centering Machines · Automatic Thread Grinders · Optical Comparators · Automatic Opening Threading Dies and Chasers · Ground Thread Flat Rolling Dies

Jones & Lamson Lathes

ARE POWERED FOR CARBIDE

Double Your Production With



GARDNER Double GRINDING

on dozens of parallel-surface parts!

BY grinding TWO parallel surfaces at ONE setting, Gardner DOUBLE Grinders often increase production as much as eight to ten times — over the single-surfacing operation previously used.

Ingenious feed-thru or rotary type fixtures make practical the parallel-surfacing of many hard-to-handle parts and materials, within the closest tolerances.

Let our engineers explain how a GARDNER Double GRINDER will step up the volume of *your* parallel-surfacing operations, or —

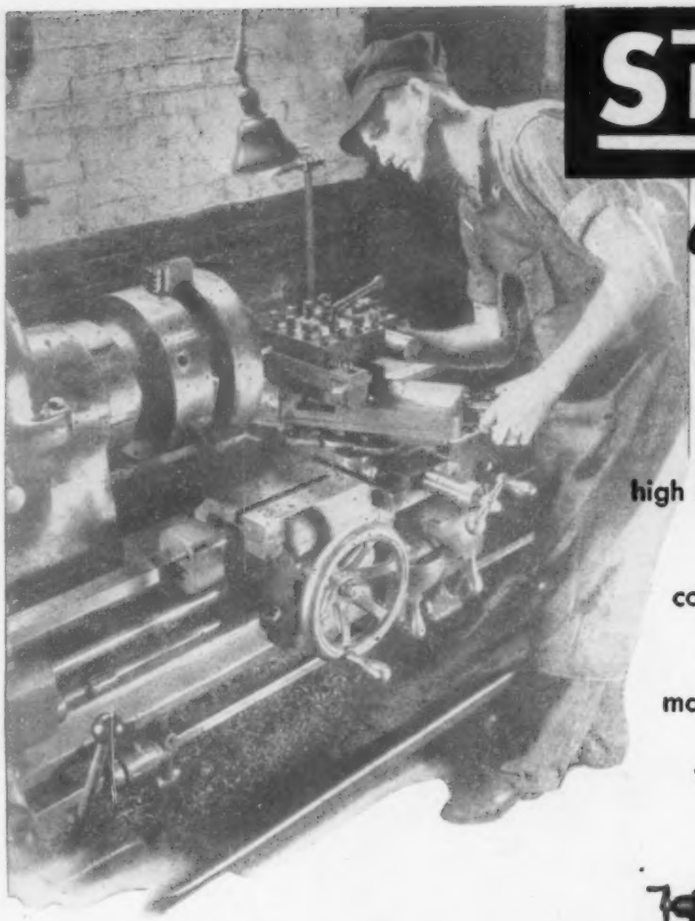
WORK DATA	
Part	Rubber Strips
Material	Hard Rubber
Operation	Grind Two Parallel Sides
Tolerances	.001" to .004" for Parallelism; .004" to .006" for Uniformity.
Stock Removal	.020" Maximum Overall
Production	15 to 40 Feet Per Minute
Feed	Hand Load to Rubber Feed Rolls
Machine	#115-18" Gardner Double Grinder

Write for Our *Double* GRINDING Bulletin!

GARDNER - GRIND YOUR *Flat* SURFACES

GARDNER MACHINE COMPANY

410 East Gardner Street . . . . Beloit, Wisconsin, U.S.A.

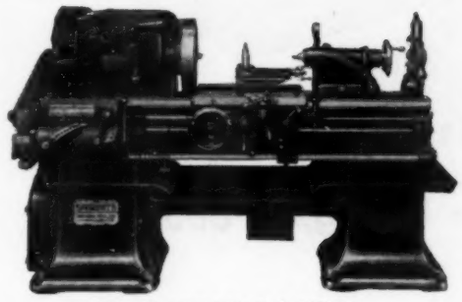


SPRINGFIELD

Geared Head LATHES

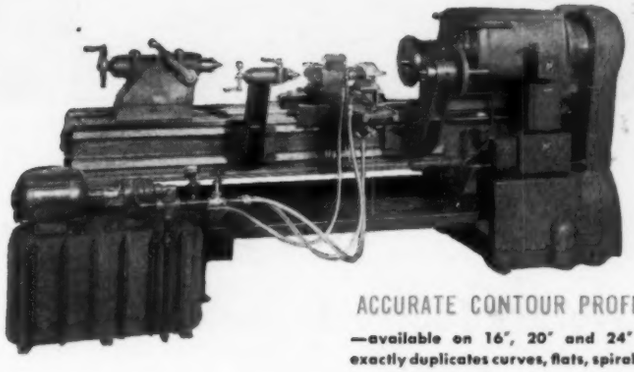
Springfield builds a complete line of precision, high quality, geared head lathes. Every type of lathe built by Springfield is especially designed and constructed to meet all the requirements of modern tooling, and to retain extreme accuracy through many years of full capacity production.

Write for catalogs and detailed specifications.



MANUFACTURING LATHE

—with unusually wide applications; capable of accurately turning, boring and facing.

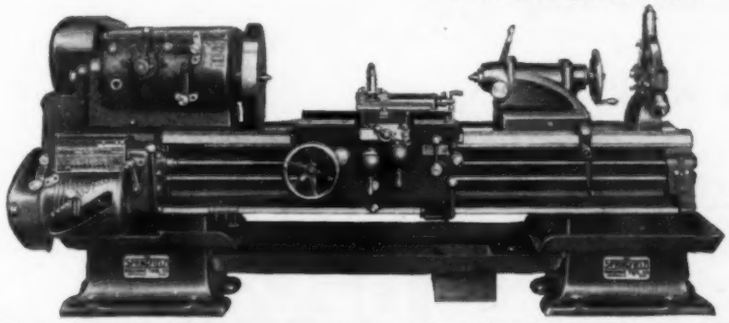


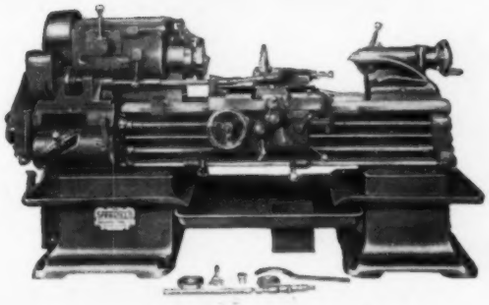
ACCURATE CONTOUR PROFILING

—available on 16", 20" and 24" lathes; exactly duplicates curves, flats, spirals, cams.

SUPER DUTY LATHES

—made in 20" and 22" sizes; equipped with 16-speed geared heads.





TOOL ROOM LATHES

—made in all sizes including 24"; equipped with lead screw reversing mechanisms.

THE SPRINGFIELD MACHINE TOOL COMPANY

SPRINGFIELD, OHIO, U. S. A.

GENERAL DISTRIBUTORS: BRYANT MACHINERY & ENGINEERING COMPANY, 400 WEST MADISON ST., CHICAGO 6

Exclusive Representatives in All Principal Cities

The DeVlieg JIGMIL is now recognized as The World's Leader in the field of accurate boring, in addition to its unique capacity for high productivity on:

1. **Single part precision boring.**
2. **Tool, jig and die work.**
3. **Repetitive production work without jigs.**

Write today for new descriptive booklet.

DeVLIEG JIGMIL

DeVLIEG MACHINE COMPANY

450 FAIR AVE., FERNDALE 20, (DETROIT) MICH.

ELECTRONIC HEATERS ON THE JOB: LATHE-BED HARDENING

uniform hardness tougher lathe ways reduced hardening cost

A LONGER LEASE ON LIFE is now being given to machine-tool lathes at the Hendey Machine Company, Torrington, Conn. Thanks to the uniform hardness made possible by a G-E electronic induction heater, precision surfaces of lathe-bed ways remain "mirror-smooth" far beyond previous life expectancy . . . are less vulnerable to precision-destroying wear and accidental damage.

At this company, lathe beds are mounted on a movable carriage, and their way surfaces are progressed under the specially mounted inductor coil of a G-E 50-kw electronic heater for uniform, controlled heating and automatic quenching.

Using the G-E electronic heater, these lathe-bed wearing surfaces are heat-treated with results unmatched by former methods. Surface hardening is accomplished with close depth control, at a faster rate, and with assured uniformity.

Net result: a better product through induction heating.

Electronic INDUCTION HEATERS

YOUR PRODUCT AND INDUCTION HEATING

Whether your product involves brazing, soldering, hardening, or annealing, be sure to get in touch with the Heating Specialist in the nearest G-E Office. His suggestions are very likely to result in higher production, lower cost, and better products, as they have for many other manufacturers. In the meantime, send for free bulletin GES-3290, "The How and What of Electronic Induction Heating." ***Sect. 675-178, Apparatus Department, General Electric Company, Schenectady 5, N. Y.***

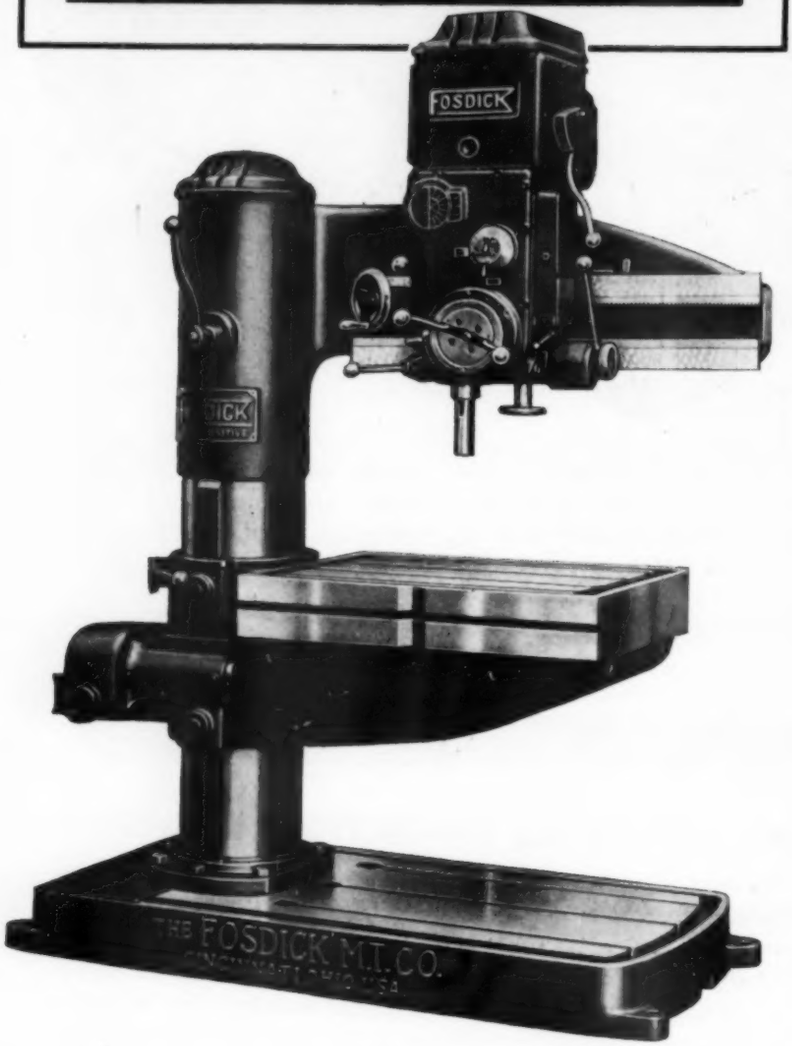
GENERAL ELECTRIC

675-178

FOSDICK

Originators of the first sensitive

RADIAL



● Fosdick was the first machine tool builder to design and produce a Sensitive Radial Drill.

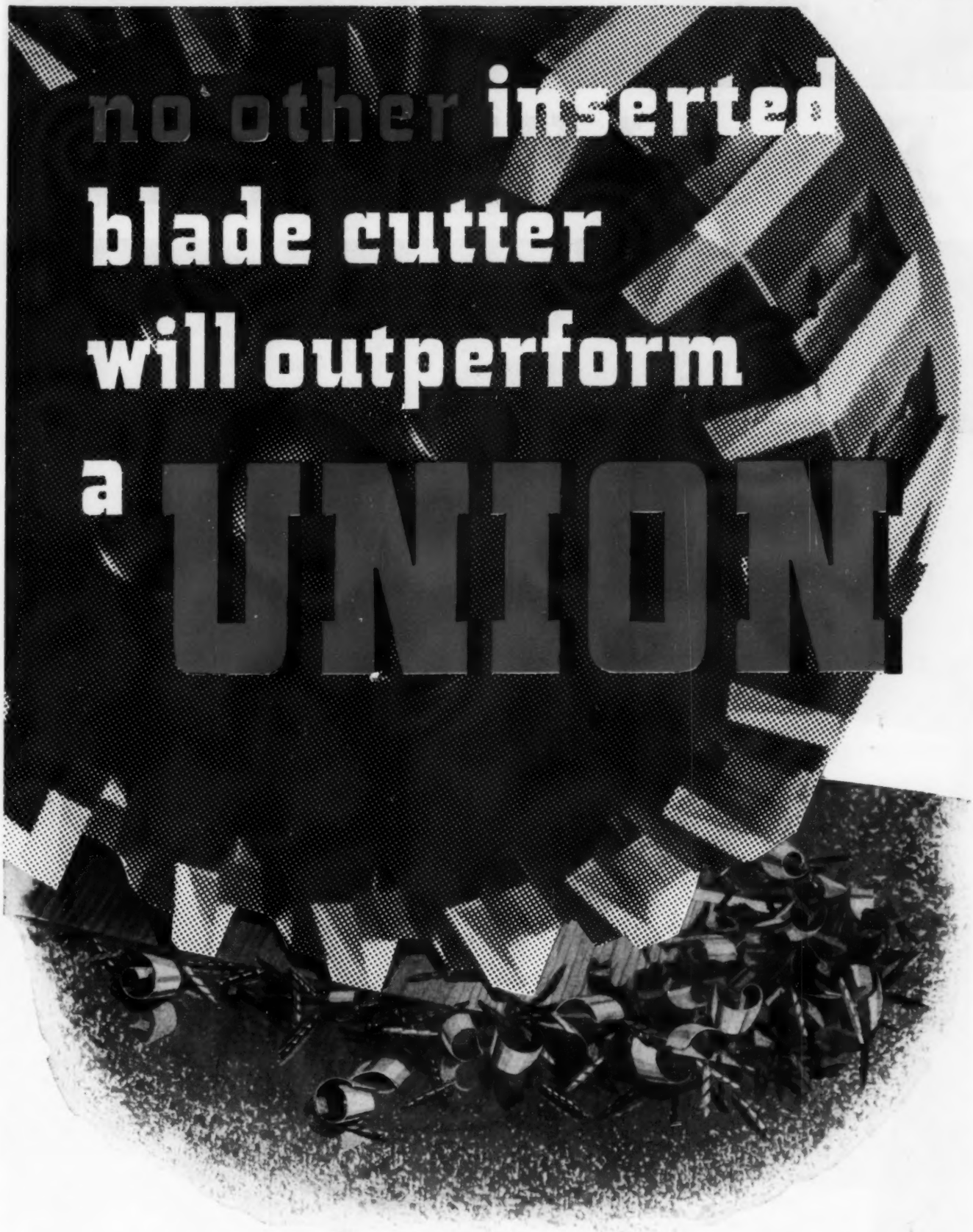
From their long experience in the manufacture of both radial and sensitive drills it was natural that Fosdick should anticipate the need for this new Sensitive of radial design.

It is an entirely new design offering all the advantages of a radial machine for sensitive drilling. For example, the arm is located at a fixed height but swings in an arc of 360°. In addition to the conventional base it has a movable table which is adjustable on the column either by hand or power. The table also swings in an arc of 360°. This design permits locating table in the proper position for any job suitable for the machine.

The head is simple in design, there are nine speeds and four feeds. These nine speeds are controlled by a direct reading lever at the bottom left hand side of the head and the four feeds by a direct reading lever on the right hand side of the head. Also available is a semi-automatic tapping control of entirely new design which speeds up the tapping operation.

For specifications and detailed information on design and construction write for the Fosdick Sensitive Radial Bulletin — R. S. A.

FOSDICK MACHINE TOOL Company
CINCINNATI 23, OHIO



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MILLING CUTTERS • GEAR CUTTERS • TWIST DRILLS • HOBS • REAMERS • CARBIDE TOOLS

We own and operate S. W. CARD MANUFACTURING CO., Division, Mansfield, Mass.
BUTTERFIELD Divisions, Derby Line, Vt., Rock Island, Quebec. Manufacturers of Taps, Dies, Screw Plates.

For ANY METAL...

SINCLAIR SUPER-WILKUT

A DEPENDABLE general purpose cutting oil saves time and money. Sinclair SUPER-WILKUT is highly efficient for all cutting work—any metal on any type of automatic screw machine. It saves time of machine and operator because change-overs from one grade or type of metal to another can be made without changing the cutting oil.

. . or Any Automatic

Sinclair SUPER-WILKUT is a sulphurized cutting oil, *but*, unlike the usual sulphurized oils, it can be used with equally satisfactory results on both ferrous and *non-ferrous* metals. SUPER-WILKUT is specially compounded to be *non-staining* and *non-corrosive*, making it particularly suitable for automatics with bronze bearings.

Sinclair SUPER-WILKUT is highly efficient both in dissipating heat from the work piece and, most important, in preventing excessive heat that tends to change dimensions of finished units and cause welding of fine chips to the cutting tool. This is proved by the successful use of SUPER-WILKUT on operations involving cemented carbide tools where recommended water emulsions proved unsatisfactory.

Let SUPER-WILKUT help solve problems in your machining operations.

SINCLAIR

INDUSTRIAL OILS

YOUR NEAREST SINCLAIR AGENT WILL GLADLY ARRANGE FOR LUBRICATION COUNSEL, OR YOU MAY WRITE TO SINCLAIR REFINING COMPANY, 630 FIFTH AVENUE, NEW YORK 20, N. Y.

Van Keuren MEASURING WIRES

STANDARD EQUIPMENT... ...everywhere

Measuring the pitch diameter of a 1"-8 National Form thread gage. This method is recommended by the Bureau of Standards.

WIRE HELIX
BEST WIRE
PITCH DIA HELIX
PITCH DIA
AXIS OF WIRE
AXIAL SECTION
CONTACT SECTION
New New New
NEW CONCEPTIONS
NEW FORMULAS
NEW TABLES
for the exact measurement of multiple worms and screws of unknown profile.
The Fundamental Fact
The axis of a wire resting in a thread assumes a position tangent to the helix passed through the center of the wire and not the point of contact.

Van Keuren Measuring Wires are the accepted standard equipment for making pitch diameter measurements of taps, thread gages, precision threaded parts, hobs, worms, splines and gears. Reputable manufacturers of ground taps and thread gages used for the production and acceptance of threaded holes and nuts use Van Keuren Measuring Wires. You will seldom find them in error if you, too, have Van Keuren Measuring Wires.

The new 1948 VK Catalog and Handbook No. 34, is a 208 page manual indispensable for engineers, designers, inspectors, toolmakers and machinists. It contains simplified formulas and accurate tables for measuring spur gears, helical gears, splines and worms. New and epoch making formulas and tables are presented for the first time for the exact measurement of 29°, 40° and 60° single and multiple start screw threads and worms. It includes a complete resume of American and European screw thread systems, new methods of measuring included angle of screw threads, a new method of inspecting flat ring seal surfaces with light waves, and other valuable information. Price $1.00 each postpaid.

Set No. 20 Thread Measuring Wires is a plant necessity for maintaining taps and thread gages within their limits for wear and for proving the pitch diameter of screws and threaded parts.

Price, High Speed Steel Wires..... $ 95.00
Price, Carboloy Wires..... 240.00

Special wires from .002" to 2.000" diameter are made to any tolerance required.

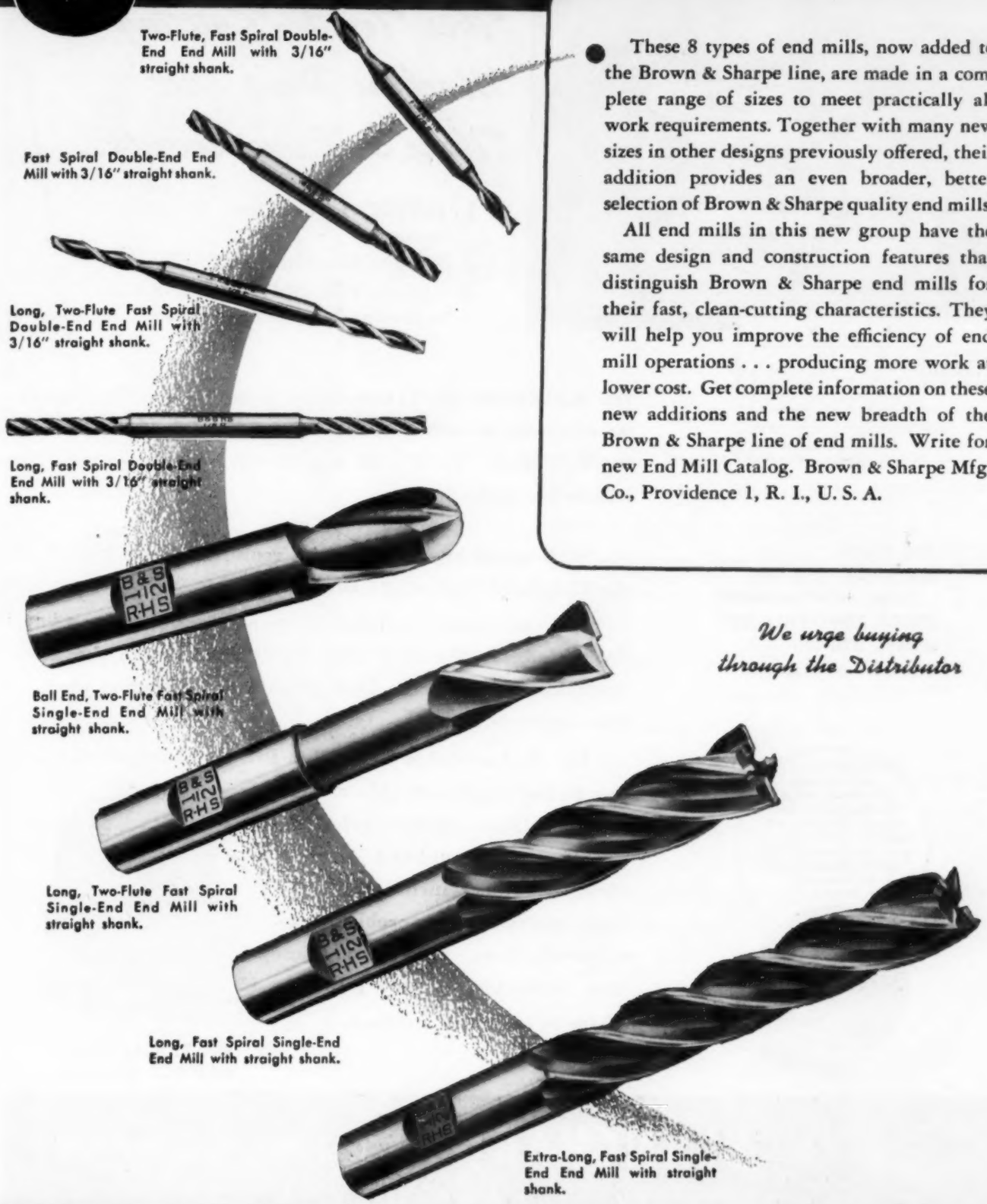
THE Van Keuren CO., 176 WALTHAM STREET, WATERTOWN, MASS.

29th YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Plug Gages • Carboloy Measuring Wires

BROWN & SHARPE *offers*

8


Two-Flute, Fast Spiral Double-End End Mill with 3/16" straight shank.
Fast Spiral Double-End End Mill with 3/16" straight shank.
Long, Two-Flute Fast Spiral Double-End End Mill with 3/16" straight shank.
Long, Fast Spiral Double-End End Mill with 3/16" straight shank.
Ball End, Two-Flute Fast Spiral Single-End End Mill with straight shank.
Long, Two-Flute Fast Spiral Single-End End Mill with straight shank.
Long, Fast Spiral Single-End End Mill with straight shank.
Extra-Long, Fast Spiral Single-End End Mill with straight shank.

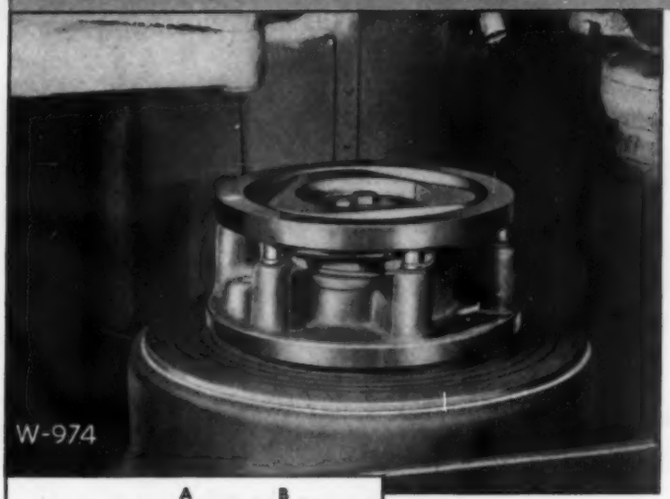
These 8 types of end mills, now added to the Brown & Sharpe line, are made in a complete range of sizes to meet practically all work requirements. Together with many new sizes in other designs previously offered, their addition provides an even broader, better selection of Brown & Sharpe quality end mills.

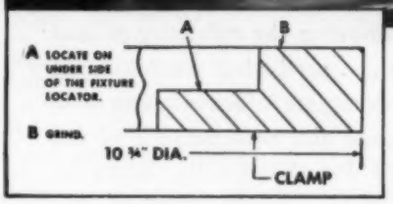
All end mills in this new group have the same design and construction features that distinguish Brown & Sharpe end mills for their fast, clean-cutting characteristics. They will help you improve the efficiency of end mill operations . . . producing more work at lower cost. Get complete information on these new additions and the new breadth of the Brown & Sharpe line of end mills. Write for new End Mill Catalog. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

We urge buying through the Distributor

BROWN & SHARPE CUTTERS B·S

"Put it on the Blanchard"





This Textile-Knitting Machine Part Met These 3 Requirements....

1. **FINISH**, better than 10 micro-inches
2. **FLATNESS** within .0005"
3. **CLOSE-TOLERANCE LINE-UP** to previously machined surfaces

THE BLANCHARD No. 11 was chosen for this job because it met all the requirements—with a PRODUCTION RATE OF 12 PIECES PER HOUR. (That's 3 x 12 = 36 requirements per hour—or 1-7/10 minutes per requirement.)

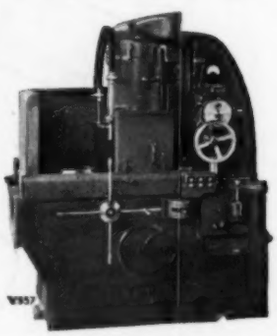
JOB DATA:
MATERIAL: Cast Iron (stress relief annealed)
STOCK REMOVAL: .008"
WHEEL: 220 Grit
CHUCK: 16" Diameter

Such speed in meeting strict requirements is typical of the Blanchard Method of Surface Grinding.

And such speed—translated into cost-per-piece—accounts for the words "BLANCHARD GRIND" alongside the most profitable figures on the Cost Investigation Sheets of production engineers.

Let the knowledge and skill of Blanchard Engineers assist you to the most profitable answer to your flat surface grinding problems. Blanchard Service (free, of course) includes a thorough analysis of your problem, recommendations, reliable production data, and sample grinding. Write us today—or anytime.

Send for your free copy of "Work Done on the Blanchard", third edition. This new book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

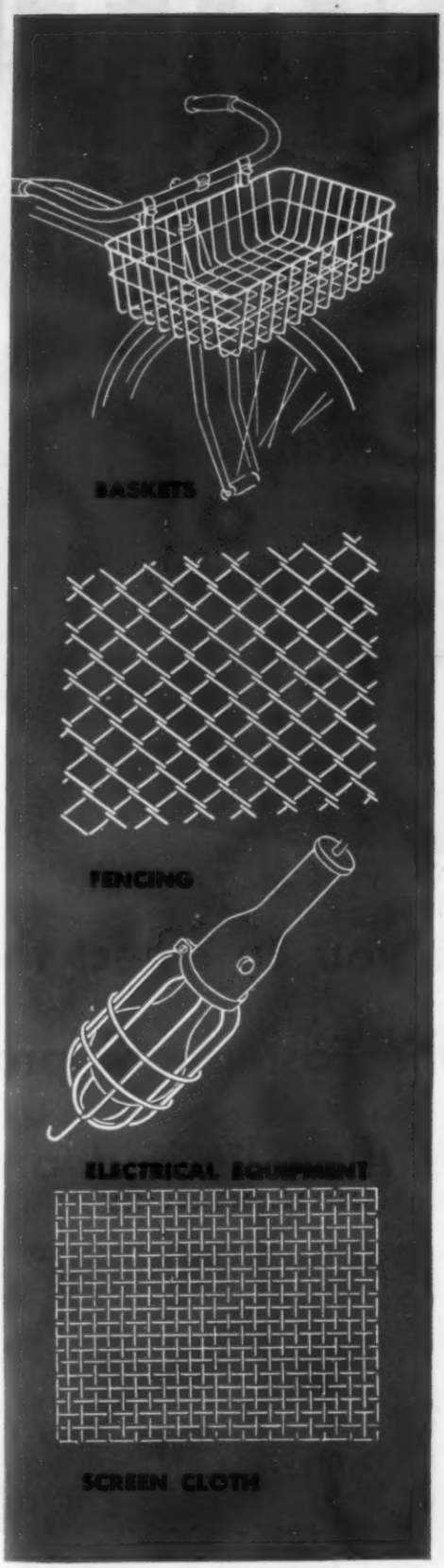


No. 11 BLANCHARD SURFACE GRINDER.

BLANCHARD

The **BLANCHARD** MACHINE COMPANY

64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.



To keep customers from seeing

RED

.. make woven wire goods from

ALCOA ALUMINUM WIRE

Your customers will never see red rust on articles made from Alcoa Aluminum Wire. No need for protective plating or painting to keep aluminum wire attractive. You save on finishing . . . the customer never needs to replate or repaint.

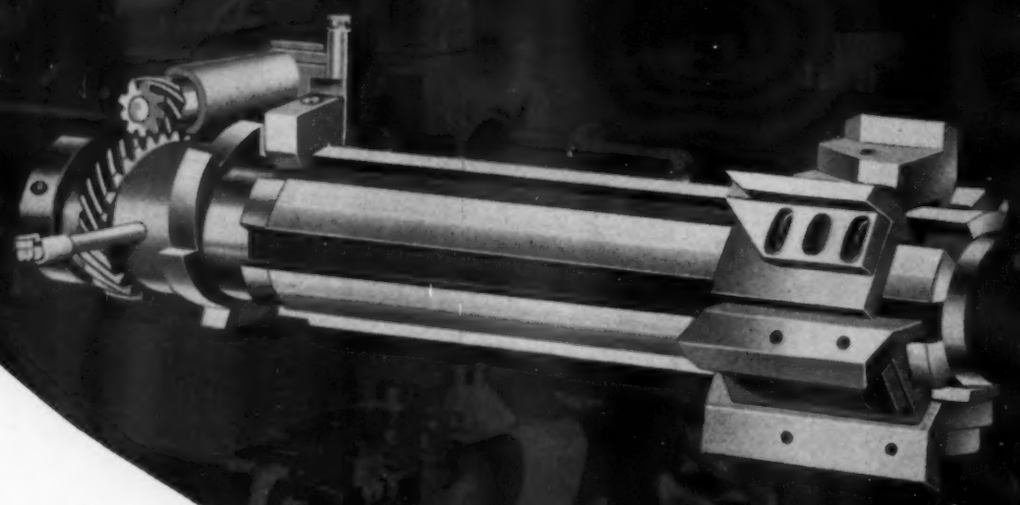
You save, too, because there are three times as many feet of wire in a pound of aluminum as in a pound of brass or steel. And the customer likes the lighter weight of aluminum.

Alcoa Aluminum Wire is made in a variety of alloys and tempers, in all standard shapes and gages to meet your requirements. ALUMINUM COMPANY OF AMERICA, 2107 Gulf Bldg., Pittsburgh 19, Pa. Sales offices in 54 leading cities.

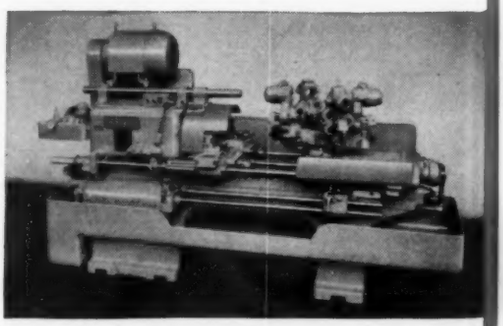
ALCOA FIRST IN **ALUMINUM**

ALCOA 1888 1948 60 YEARS OF SERVICE

GISHOLT
Fastermatics
(AUTOMATIC TURRET LATHES)



This simple control drum enables you to select the BEST feed for EACH cut because the Fastermatic provides infinite feed selection rather than limited and fixed gear ratios. Thus it makes feed selection efficient, quick and easy. Write for literature.



THE GISHOLT ROUND TABLE represents the collective experience of specialists in machining, surface-finishing and balancing of round or partly round parts. Your problems are welcomed here.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

Turret Lathes · Automatic Lathes · Superfinishers · Balancers · Special Machi

Now available with wet cutting system...

the

WELLS No. 12

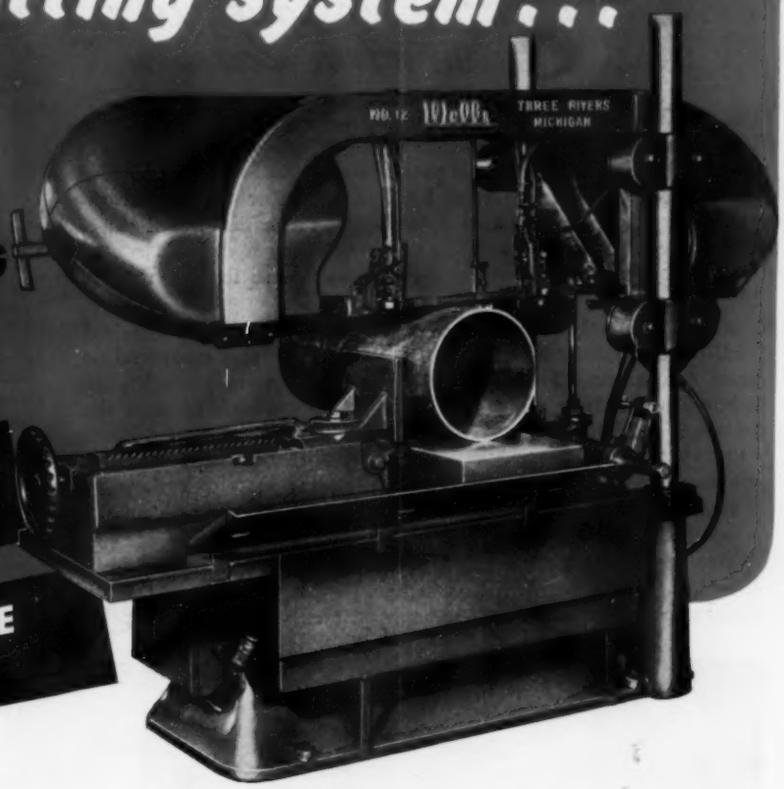
METAL CUTTING BAND SAW!

featuring

AUTOMATIC CUTTING CYCLE...

and

CONTROLLED BLADE PRESSURE



DESIGN DETAILS

- Cutting action parallel to bed.
- Easily controlled depth cutting.
- Automatic frame return and blade motor shut off.
- Large capacity — 12" x 16", rectangular; 12¾", rounds; die blocks: 12¾" deep, 16" wide, 18" clearance bed to blade.
- Selective speeds: 50, 90, or 150 ft. per min.
- Ample power: ¾ H.P. blade motor, ⅓ H.P. hydraulic system motor.
- Weight: *approximately 1845 lbs.

The heavy duty, hydraulically operated Wells No. 12 Metal Cutting Band Saw, with automatic cutting cycle and special blade pressure controls, is now available with a NEW time and money saving extra — the Wells wet cutting system. This complete self-contained system permits safe use of higher f.p.m. cutting speeds and increases blade efficiency. Installed as an integral part of the saw, the system includes chip pan, fluid tank, centrifugal type pump unit, screened intake, splash guards, and flow control valve. Ask your Wells Saw Dealer for full information or write direct to the factory.

Wells SAWS

Wells

Products by Wells are Practical

METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORPORATION
505 ROOSEVELT RD., THREE RIVERS, MICH.

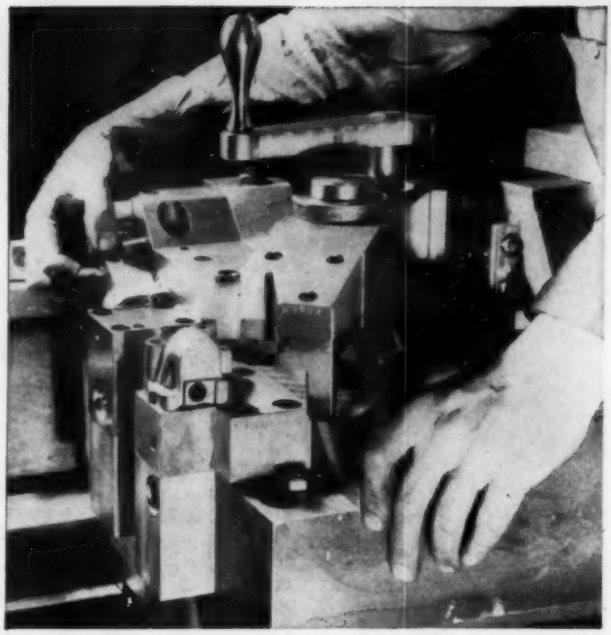
SPEAKING OF FIXTURES...

FASTER LOADING AND UNLOADING MEANS HIGHER PRODUCTION AT LOWER COST— BY BROACHING THE American WAY

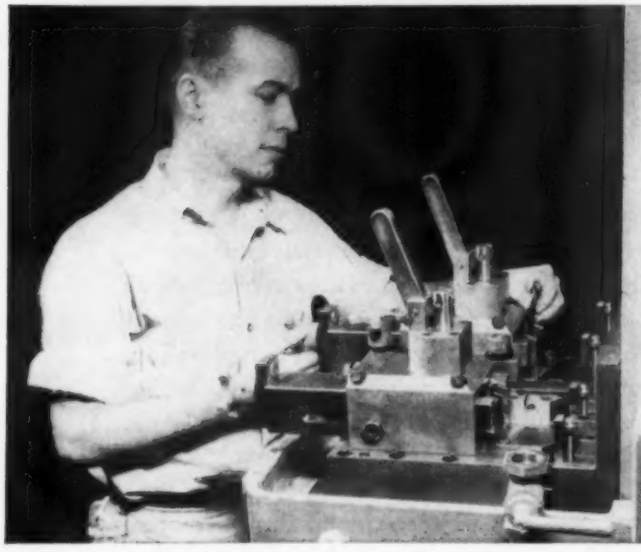
One of the most important elements of a good broaching job is the work holding fixture. *American* engineers know that to provide accurate and productive surface broaching the work holding fixture must be designed for easy loading, clamping, unclamping and unloading in a minimum of time. Whenever feasible, *American* engineers use hydraulic or air clamping on surface broaching operations to further reduce loading time.

Many internal operations are adapted to *American* Vertical Pull-Up Machines which can be either step-cycle operated or semi-automatic. When the shape of the parts permits, an automatic loading slide unit is provided, which locates the part for the broaching stroke and ejects the finished pieces. Operator has only to keep the magazine unit filled as the machine runs continuously with all cycles interlocked.

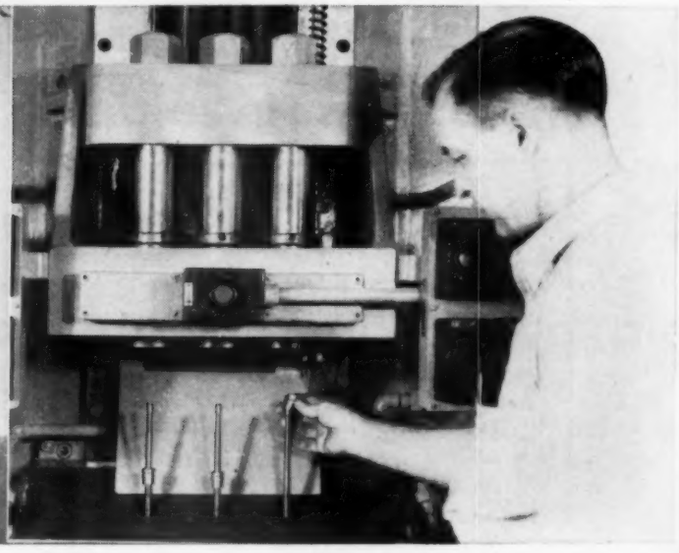
Bulletins giving details on *American* broaching equipment —machines, tools and fixtures—are available on request. Write for full information today. If you have a specific job in mind, send specifications, blue print, or sample part. No obligation of course. Address inquiries to Department M.



American Single Ram Machine features hydraulically operated receding work table for broaching three surfaces of automotive part. Two surfaces are broached in left hand fixture, and one surface in right hand, in one pass of the ram. Table is shown in loading position, clear of broaches and ram. After loading and clamping parts, operator starts cycle through use of dual push buttons. At end of broaching stroke, table recedes to reloading position.



A very simple type of fixture for internal, keyway, or spline broaching, where radial location need not be maintained with a previous machining operation, is shown here. Operator loads this *American* Vertical Pull-Up Machine by dropping parts over shank ends of broaches. Parts are automatically ejected by a deflector plate at end of broaching stroke. Exceptionally high production is obtained.



A simplified three-station fixture is used on this *American* Three-Way Machine to broach flat parts. Individual sliding stations are receded to load parts clear of the broaches; stations are then positioned and clamped with all three parts broached at one stroke of the ram.

AMERICAN *American* BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

See *American* First—for the Best in Broaching Tools, Broaching Machines, Special Machinery

Turn to INGERSOLL when you need—

Special Steels FOR Special USES

ENGINEERING B-W PRODUCTION

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Alloy Steels • Armor Plate • Clutch Plate Steels
Tillage Steels • Soft Center Steel • Shovel Steels
Knife Steels • Saw Steels, including Hack Saw
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INGACLAD Stainless-Clad Steel

INGERSOLL STEEL DIVISION

Borg-Warner Corporation, New Castle, Indiana • Plants: New Castle, Indiana; Chicago, Illinois; Kalamazoo, Michigan

the A-B-C's of SCULLY-JONES ARBORS

Absolute Accuracy

Better Service

Continual Cost Reduction

Absolute Accuracy, as well as stamina, are assured in long production runs, because of the careful heat treating and grinding of Scully-Jones Arbors, at every step from rough forgings to finished tool.

Better Service to you, because large stocks of Scully-Jones Arbors are maintained from which your requirements can be filled immediately.

Continual Cost Reduction is accomplished by Scully-Jones Individual Arbor Set-Ups.

Standard Arbors for all machines having N. M. T. B. Tapers. See Pages 112 and 114, Scully-Jones Catalog No. 500, for Style A and B Arbors. Send drawings or specifications for prompt quotations on special arbors.

Refer to the Scully-Jones Catalog showing over 500 types and sizes of cutting tools, collet chucks, boring equipment, centers, etc.

Scully-Jones AND COMPANY

1902 **SOUTH ROCKWELL STREET** • **CHICAGO 8, U.S.A.**

SNOW FULL UNIVERSAL DRILLING MACHINE

The SNOW Full Universal Drilling Machine permits the drill to set its own rate of feed resulting in higher production and greater tool life.

Precision limit switches offer extremely accurate depth control and allow instant synchronization of the many types of air operated indexing and clamping fixtures and jigs which have been designed for use with this machine. Low pressure air control built into this full universal equipment, combined with quality design and construction results in a sensitive and sturdy production machine.

This machine is capable of operating as high as 6,000 strokes per hour and has been production-tested in thousands of installations.

We suggest that you submit sample parts and blue prints for specific recommendations, production estimates and tooling data.

SNOW MANUFACTURING COMPANY

437 EASTERN AVE., BELLWOOD, ILL. • SUBURB OF CHICAGO

Costing too much to dress your wheels?

. . better use ROBERTSON!

Talk about upkeep! The conventional wheel, which rapidly becomes loaded and constantly has to be dressed and redressed, is doubly expensive. Not only does it wear out faster, but the time spent dressing it represents additional cost, and is time lost from production.

You don't have to baby Robertson Grinding Wheels. They resist loading because their revolutionary "open" structure allows plenty of space for chip clearance. And the results they achieve are outstanding. Take this instance:

A Landis Plain Cylindrical Grinding Machine was turning out only 60 pieces per wheel dressing, using a straight plunge cut with a conventional wheel to remove .015" to .020" stock from 1020 steel bushings, hardened and carbonized to Rockwell C 53-55. When a Robertson sales-engineer was called in, he recommended our RA 464-MV wheel. On the same job, under the same conditions, production was increased to 220 pieces per dressing—nearly four times as many!

The plant superintendent watched this performance with amazement. "That's a *good* wheel," he said. "I don't believe it will ever wear out."

Robertson Grinding Wheels *are* good wheels, precision-built to handle the toughest jobs. Specify Robertson vitrified-bonded or resin-bonded wheels for cool cutting, even on the hardest metals—for accurate, fast production—and for lowered grinding costs. For unusual jobs, blueprint your problem, and let us recommend a wheel for your particular job.

ROBERTSON COOL-CUT

ROBERTSON MANUFACTURING COMPANY

TRENTON 5, NEW JERSEY

Resin-Bonded and Vitrified-Bonded Grinding Wheels • Mounted Wheels • Segments

More Efficient hobbing

ON
BARBER-COLMAN
No. 16-16
HOBBING MACHINES

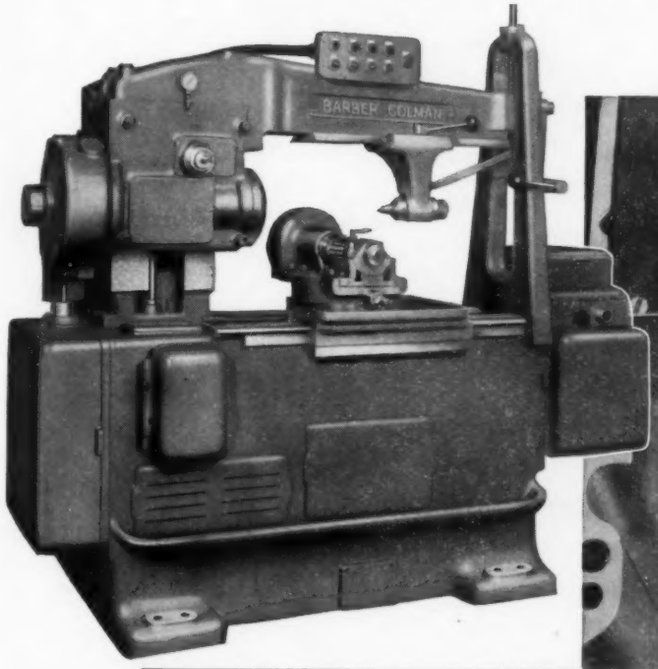
Hobbing efficiency today is determined essentially by the amount of time and effort required of the operator in keeping his machine producing. Maximum efficiency can be reached only when the human element is reduced to the point where many machines can be handled easier by fewer people.

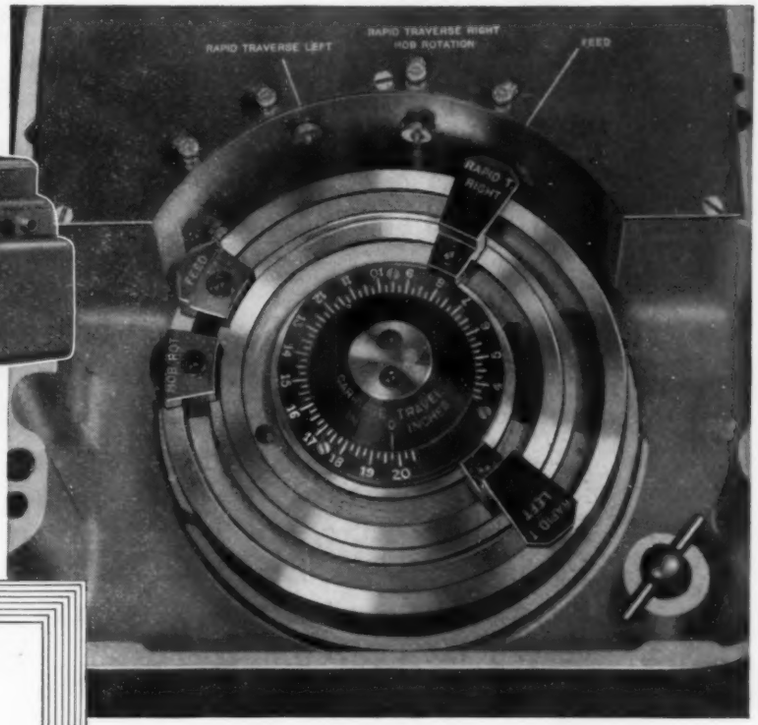
The Barber-Colman No. 16-16 Hobbing Machine features many new operating aids destined to give you this efficiency. For instance . . . the new Dial Stop Selector, shown below, greatly simplifies the feed and traverse settings, for *either* climb or conventional hobbing. The dial is calibrated in inches of travel, so that a simple reading quickly tells the operator exactly where to set his stops for a particular job. The same dial automatically stops the hob rotation at the end of the cut, and a push-button rapid traverses the carriage to the starting position for the next cut. It's that simple — with no hand-cranking or straining to tire the operator.

Investigate the new No. 16-16 Hobbing Machine if you have gears, splines or sprockets ranging up to 16″ diameter and 16″ face length

Barber-Colman Company

GENERAL OFFICES AND PLANT 110 LOOMIS ST., ROCKFORD, ILLINOIS, U.S.A.





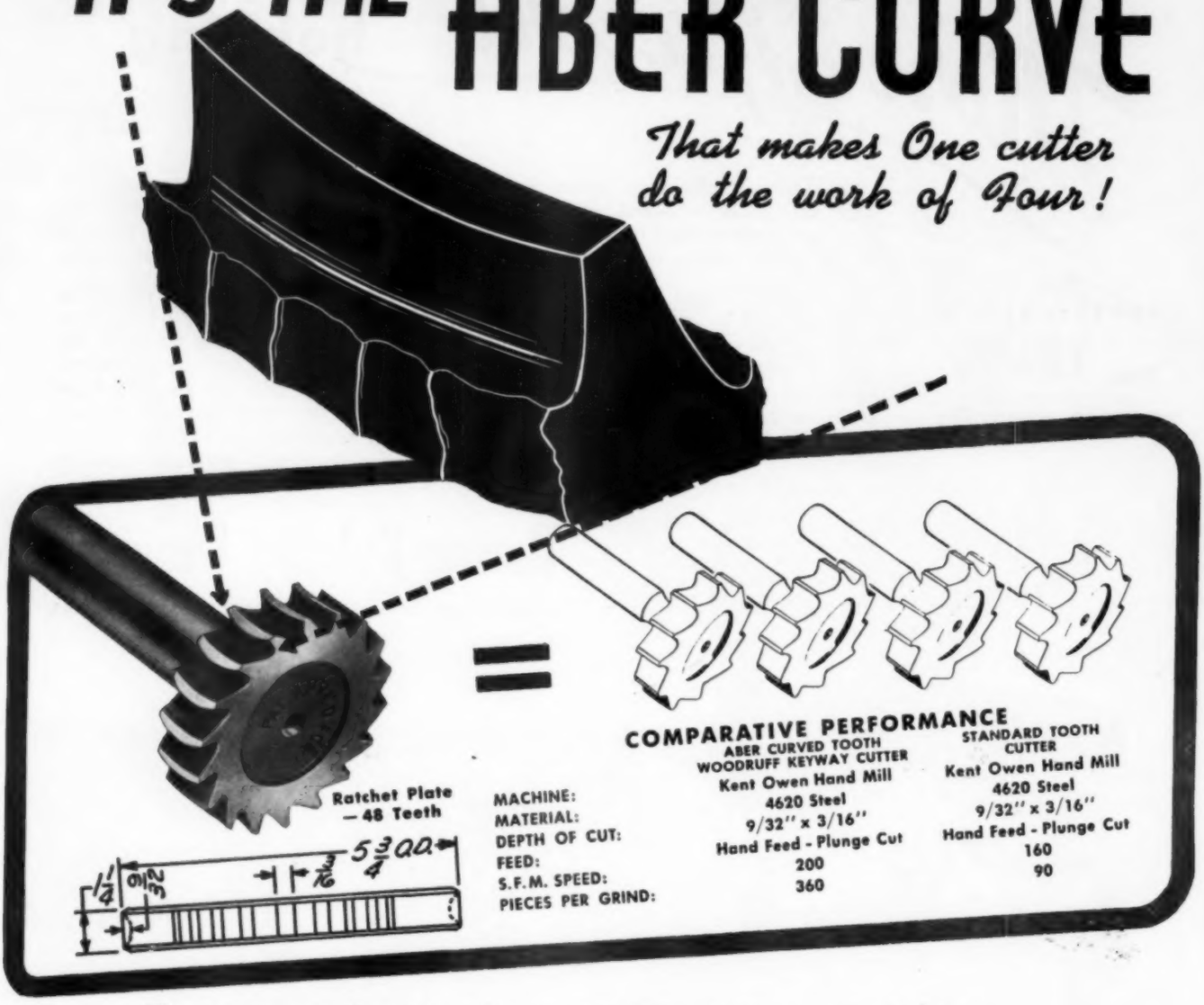
FEATURES:

- CENTRAL PUSH-BUTTON CONTROLS
- DIAL STOP SELECTOR
- CLIMB OR CONVENTIONAL CUT
- BACKLASH ELIMINATOR
- RAPID TRAVERSE EITHER DIRECTION
- HOB ROTATION SELECTOR
- HEAVY-DUTY CONSTRUCTION

BARBER COLMAN — A COMPLETE HOBBING SERVICE

IT'S THE ABER CURVE

That makes One cutter do the work of Four!



COMPARATIVE PERFORMANCE

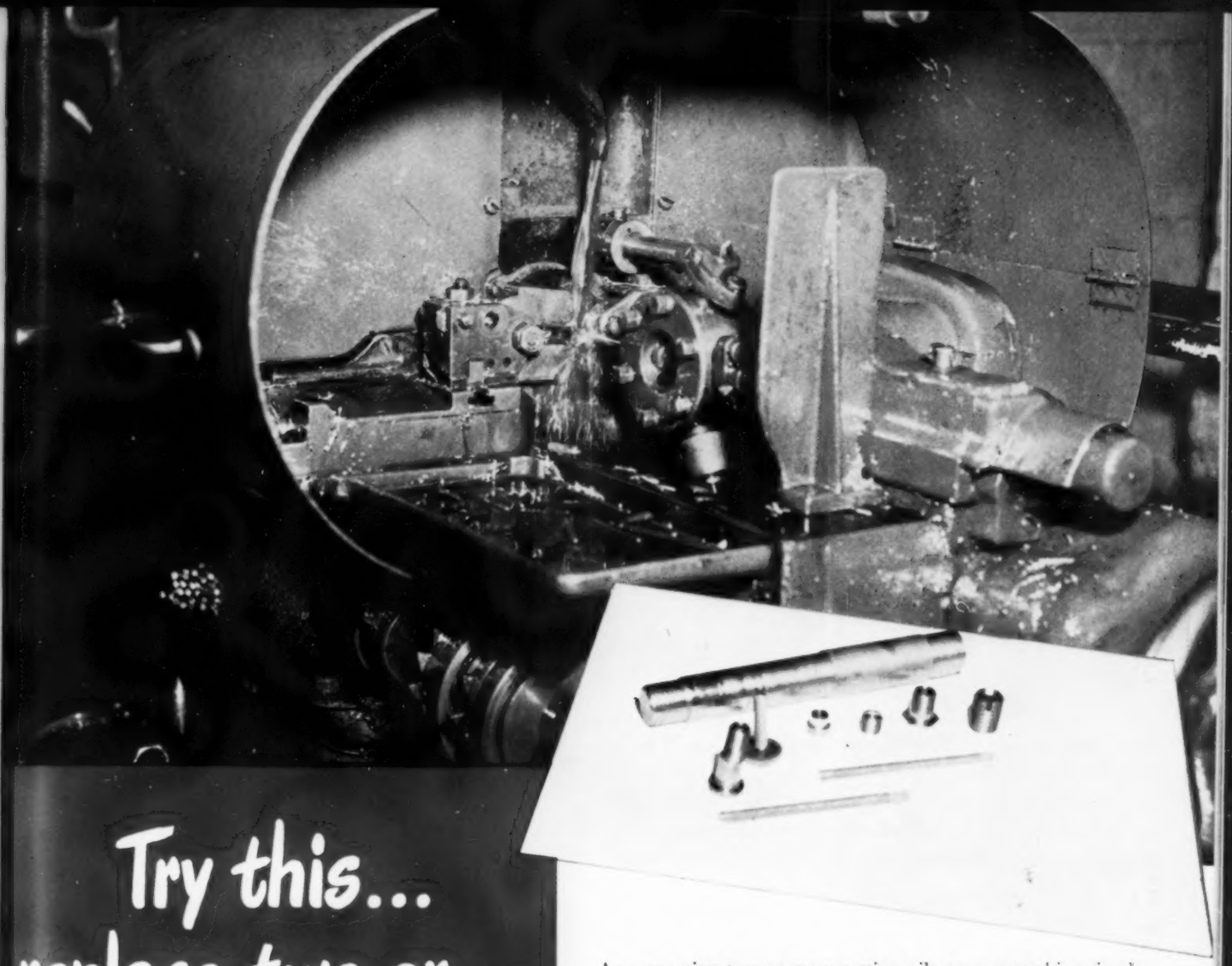
	ABER CURVED TOOTH WOODRUFF KEYWAY CUTTER	STANDARD TOOTH CUTTER
MACHINE:	Kent Owen Hand Mill	Kent Owen Hand Mill
MATERIAL:	4620 Steel	4620 Steel
DEPTH OF CUT:	9/32" x 3/16"	9/32" x 3/16"
FEED:	Hand Feed - Plunge Cut	Hand Feed - Plunge Cut
S.F.M. SPEED:	200	160
PIECES PER GRIND:	360	90

Yes, in an actual test in a large pipe threading company's shop, ONE Aber Curved Tooth Woodruff Keyway cutter performed the work ordinarily requiring FOUR cutters of standard tooth design. This 400% increase in cutter performance is by no means unusual, for Aber's exclusive curved tooth design permits a smoother finish, absence of chatter, greatly increased cutter life, and cuts more freely with far less hand pressure from the operator. In addition, it proved to be a tremendous saver of "down" time, and reduced costs in the cutter grind room.

Write today for your free copy of the new Aber Catalog, containing a wealth of information on the latest developments in the milling cutter field. A sound, practical guide to cutter buying.

ABER

ENGINEERING WORKS INC.
WATERFORD, WISCONSIN



Try this... replace two or more cutting oils with

Stanicut No. 137 BCS

Are you using two or more cutting oils on one machine simply because operations involve various metals and parts? If so, you may be losing production time needlessly by changing cutting oils between jobs. You are also running the risk of additional losses through misapplication of these cutting oils. Here is how a midwest machine shop avoided these difficulties.

This shop machines a large variety of parts, similar to those shown above. Materials include various alloys, brass, copper, and aluminum. Machining operations include turning, forming, threading, tapping, drilling and reaming. The problem of finding one cutting oil to handle successfully all of the jobs was turned over to a Standard Cutting Oil Engineer.

He recommended Stanicut No. 137 BCS. In three years' use, this multi-purpose cutting fluid has produced the required finish on all parts, with no staining of nonferrous metals. It has given uniformly good tool life on all operations. Materials and set-ups can be changed on the machines without taking time to shift cutting oils. Results: higher production of parts, no costly stocking of special cutting fluids.

You will find a Standard Cutting Oil Engineer helpful in improving machining economy and part quality in your plant. His wide experience with Standard cutting oils and coolants will prove to be a valuable aid in solving your particular cutting oil problem. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY (INDIANA) STANDARD

948

Why not use one oil for all your hydraulic systems?

STANOIL Industrial Oil

Are you using two or more special oils to take care of the various hydraulic operations in your plant? If so, you may find it profitable to shift to Stanoil. It has proved its ability to improve hydraulic operation through a wide range of service. Take for example these two different applications.

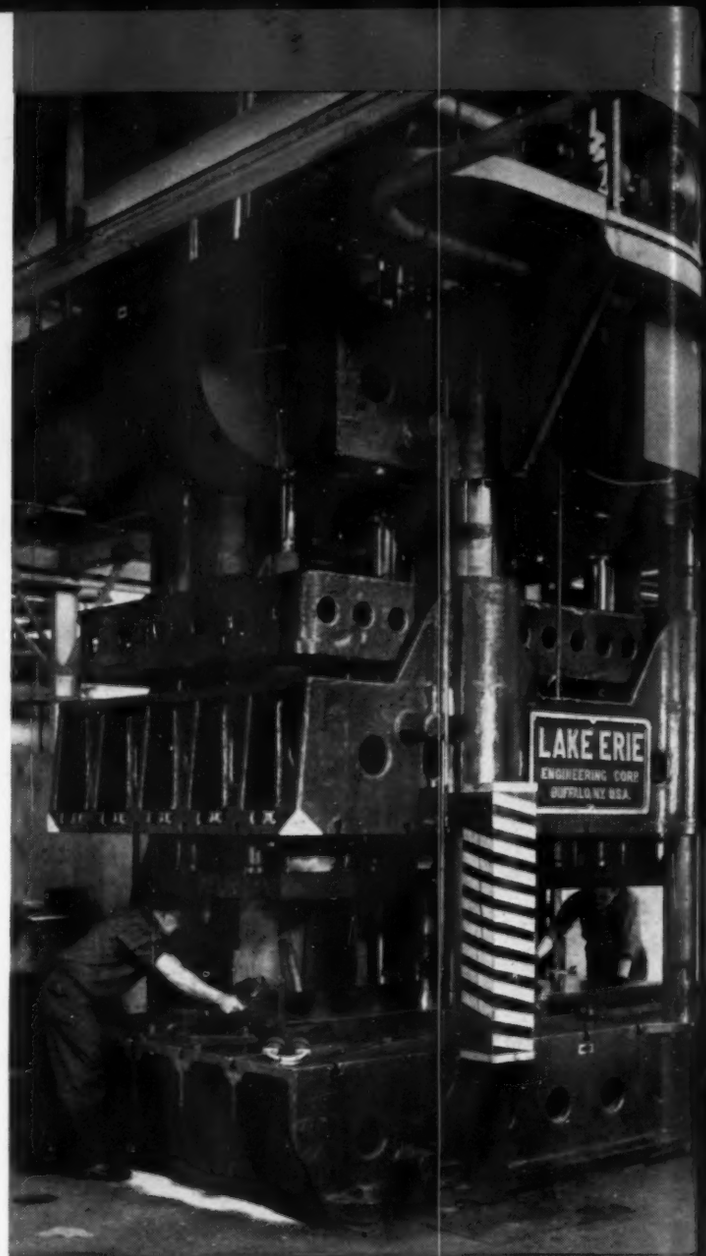
Greater Reliability

After three years' operation in the large hydraulic press, shown at the right, the original fill of Stanoil showed only a trace of oxidized oil and no appreciable change in viscosity. Because of the high stability of Stanoil, the hydraulic system stayed clean and the hydraulic controls functioned smoothly at all times.

Little Maintenance

A switch to Stanoil in the hydraulic feed mechanism, shown at the right, stopped varnish trouble and eliminated the frequent cleaning jobs required with the use of a conventional oil. Where previously the hydraulic oil had to be changed every three months, the original fill of Stanoil has shown practically no deterioration after three years of service.

Stanoil contains an oxidation inhibitor and an anti-foam additive that contribute to long oil life and clean, reliable operation of hydraulic units, speed reducers, and circulating systems. A Standard Oil Lubrication Engineer will help you put this economical oil to work in your plant. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

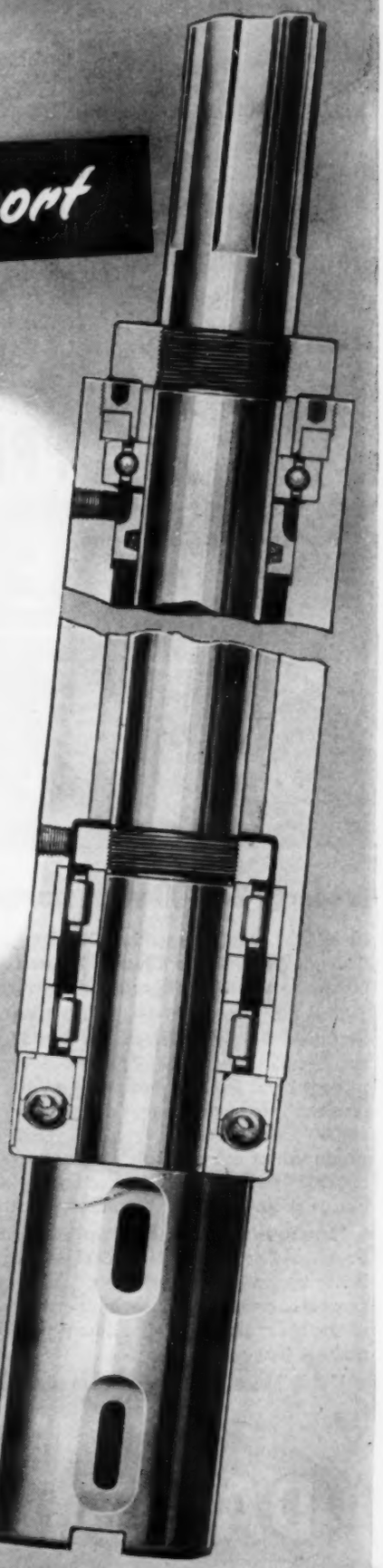


STANDARD OIL COMPANY (INDIANA)

STANDARD

Unusual Tool Capacity

Unusual Spindle Support

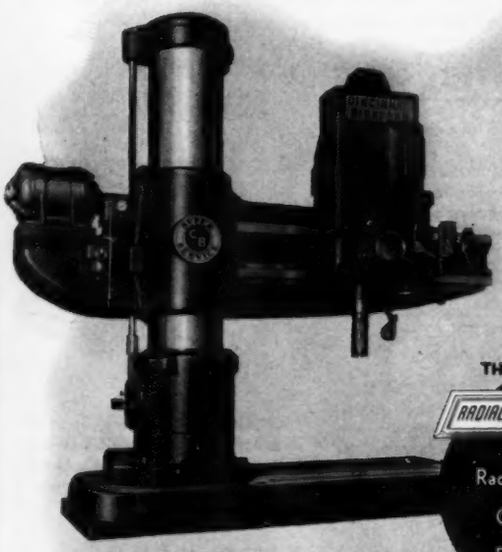


What is full spindle support? What does it accomplish? It's rigid support against thrust and radial load—at ALL positions of the spindle.

In performance, it means accurate, smooth power delivery and long, trouble-free operation.

The multiple spline driven Cincinnati Bickford Super Service Spindle—with its large thrust bearing and its special sliding sleeve—never feeds away from its bearings.

This modern, up-to-date design, with 36 speeds and 18 feeds, also gives a maximum tool capacity for any given size.



Write for Circular R-29 for details of construction of this Cincinnati Bickford Super Service Radial Drill.

This machine is furnished in sizes 11" to 19" diameter column, 3' to 8' arm.

THE CINCINNATI BICKFORD TOOL CO.

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

Radials 7½" dia. col., 2½' arm, to 26" dia. col., 12' arm.
General purpose Uprights, 21" to 28" sizes.
Production Uprights, 21" to 28".
Jig Borers, Portable Horizontals, Spacing Table Machines.

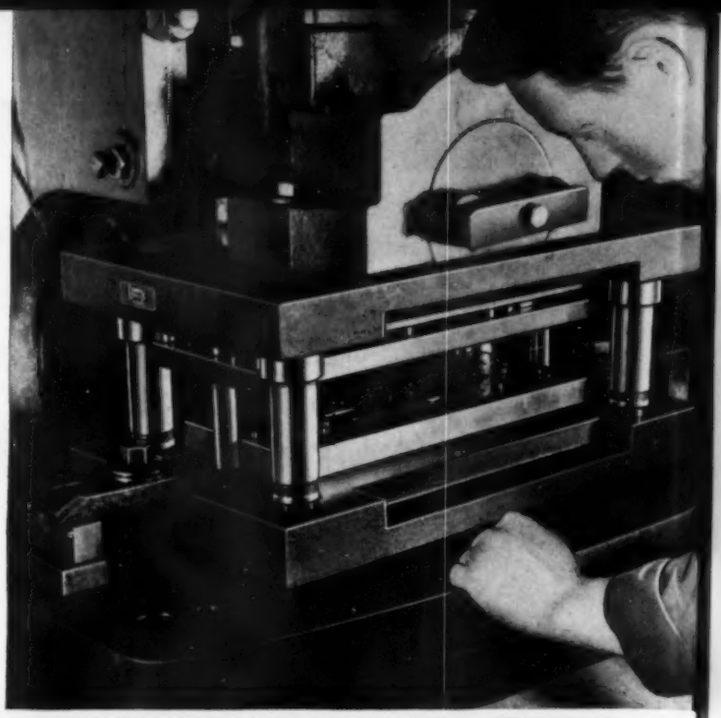
Equal Efficiency of Every Unit Makes the Balanced Machine

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

Precision stampings at Felt & Tarrant speed assembly of Comptometers

tolerances of 0.0005" held on 65 holes

... using DANLY PRECISION DIE SET



produces 23,000 steel stampings per grind

Here is a Danly Precision Die Set employed by Felt & Tarrant Mfg. Co. of Chicago to produce frame plates for comptometers—high-speed adding-calculating machines.

The die illustrated is mounted on a four-post Danly Standard Semi-Steel Precision Set. It trims, pierces, and notches 65 holes in .035 cold rolled strip steel. The work-piece is hand fed and positioned on dowel pins. A two-post stripper is used to prevent distortion. Production averages 23,000 pieces between grinds. Typical of other stampings produced for comptometers with Danly Die Sets, tolerance of .0005" on each hole is maintained which speeds assembly line work and permits complete interchangeability of parts.

Here again is evidence of the inherent accuracy of Danly Precision Die Sets under actual press operating conditions. Built to precision tolerances (guide posts and bushings ground to limits of .0002") they permit taking full advantage of the die maker's precision, help you hold close tolerances and get longer tool life.

Danly has a wide range of standard stock sizes available which can be quickly assembled and delivered to help you save time and money.

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Consult our engineering department for helpful recommendations on die sets—large or small, standard or special—*for any type of press operation.*

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Danly offices in 10 key cities give immediate attention to your orders. Assembly plants (marked with stars) stock interchangeable parts for quick assembly and delivery of any standard die set to your specifications.

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- ★ **Cleveland 14,** 1550 E. 33rd St.
- ★ **Dayton 2,** 990 E. Monument Ave.
- ★ **Detroit 16,** 1549 Temple Ave.
- ★ **Grand Rapids,** 113 Michigan Ave., N. W.
- ★ **Long Island City 1,** 47-28 37th St.
- ★ **Los Angeles 54,** Ducommun Metals & Supply Co., 4890 S. Alameda
- ● **Milwaukee 2,** 111 E. Wisconsin Ave.
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Illustrates how Danly's Special Machining and Welding Service can save you time and money for unusual die set applications.

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2100 SOUTH 52ND AVENUE, CHICAGO 50, ILLINOIS

PRECISION DIE SETS...STANDARD AND SPECIAL | MECHANICAL PRESSES AND PRESS EQUIPMENT

SPOT NEWS OF METALWORKING

Machine tools held up for lack of import licenses to Russia and satellites must be purchased at not less than original contract price, plus any conversion costs, by ECA administrator for use in Marshall Plan countries, according to ERP appropriations bill passed by Congress. Bill covers orders placed before March 1, 1948, but almost all such orders date from first half of 1947 when Washington was encouraging eastern European trade.

Uniform procurement regulations for all three armed services should be set up by August 1, according to high Pentagon authority.

Agent of a large British machine-tool builder is calling on American dealers to induce them to take on the firm's complete line. The company is reported to visualize a network of dealers from coast to coast, the machines being serviced from a warehouse in Cleveland. The plan has the British government's sanction.

Russian jet plane, version of DFS 346, has been flown at 745 miles per hour, according to McGraw-Hill's "Aviation Week." It has swept-back wings, fin and tail surfaces set on top of the fin. Russia also has a four-jet bomber resembling the Boeing XB-47 and a twin-engine bomber with engines believed to be modified Junkers axial flow units.

The Ransberg electrostatic method of painting bodies is being investigated by two automobile makers. The aim is to get a uniform thickness of coat rather than to conserve overspray.

One precision casting company makes all core boxes from a single master pattern, using a thermosetting plastic for the box. No wood patterns at all.

First ECA letter of commitment for financing Marshall Plan orders was issued to Bank of Manhattan in New York. Ten other banks also have received such letters. Big problem is to adapt normal banking methods in export financing to government requirements. Solution is to make the bank an agent of the participating country, thus relieving it of any liability in case of a "bad delivery."

Trend toward smaller requirement for direct labor is counterbalanced by an increase in indirect labor in the hard goods industries, according to productivity data gathered by government and private economists.

Buick torque converter plaster mold castings are so precise that only the hub hole must be machined and edges trimmed. No finishing of blades is necessary. Demand is so great that GM's Allison Division is looking for another plant to produce the castings.

How renegotiation is to be administered is a problem yet to be decided by the armed services. No decision has been made as to who will be delegated to work out the details.

A huge locomotive factory at Jamshedpur, India, is being built by Tata at cost of $22 million. Upon completion in 1951 it will be able to produce 100 locomotives and 100 spare boilers a year. Baldwin Locomotive is reported cooperating with Tata.

Economical materials handling is key to success of new Ford coil-spring plant at Hamilton, Ohio. From freight car to finished springs, the only hand work is in forging spring end, loading in quenching machine, transferring to drawing furnace conveyor, hooking on paint conveyor chain and loading on expendable cardboard pallets.

Gaging Metalworking

Much of the tooling for the jet engine program is likely to be placed within the next 30 to 60 days. No one knows for sure how much tooling will be required, but it may run as high as $300 million. The total will include machine tools, presses, welding and heat-treating units, materials-handling equipment, tools and dies, and all other production machinery needed to expand production of current jet engines to 2000 units a month.

Orders for new machine tools alone for this program may hit $100 million, and might go even higher. They will be bought by individual contractors and will be subject to renegotiation. Contractors have been asked by the Air Force to comb government surpluses for suitable machines, but relatively few desirable units are expected to be found.

Long-Range Program Active

On top of this immediate action is a long-range program tied in with development of new types of jet planes and engines. Machining problems in connection with the latter program must be solved before much progress can be made. No matter what the size of defense operations may be, there is no chance whatever, short of an outright war emergency, that machine tool requirements will come within shooting distance of the 260,000 units widely reported in the press. The maximum figure more likely will be 100,000 units, and there is no assurance that it will get even that high.

Unfilled orders for machine tools at the end of 1948 should be considerably greater than today. However, a false impression is going round that the machine tool industry is booming.

The fact is that builders recently hit a "dead spot" in both orders and inquiries. Bookings have flattened out surprisingly. This unfavorable development extends into all segments of the industry in varying degrees. Companies building special-purpose equipment have suffered less than the average.

A sharp drop in export demand is partially responsible for the current low ebb in new orders. Foreign business has averaged less than 10% of the industry's total, whereas until recently it was 20 or 30%. European agents of U.S. builders have plenty of pending orders at hand. The belief is growing here that some of this business can be financed with dollars now available in the countries of destination; but the prospective customers are holding off to see whether they can get all or part of what they want free of charge through ECA.

ECA Orders Delayed

ECA commitments for machine tools, as well as for other capital goods, will not hit their stride until the first quarter of 1949. First orders are not expected to be delayed that long, however. They probably will come in the final quarter, and possibly in the third quarter. Meanwhile some builders report a trickle of business from Europe, especially Switzerland, Belgium and Sweden. The Latin American countries, particularly Brazil and the Argentine, are seeking U.S. machines more actively.

Aside from shutdowns for summer vacations, the nation's metalworking industries will go through the third quarter at an exceptionally high rate of operation. There are a few notable exceptions, such as the machine tool industry, where sales are lagging at least temporarily.

Third-round wage increases are triggering off some price boosts. Though not yet established as a firm pattern, and not likely to spread as fast as rounds one and two, 1948 wage advances are putting pressure on prices.

The price increases, even more than wage increases, will not jell into a pattern. Growing competition and customer resistance must be considered. Because of this lack of a pattern, most companies cannot yet tell how wage and price increases will affect their materials cost.

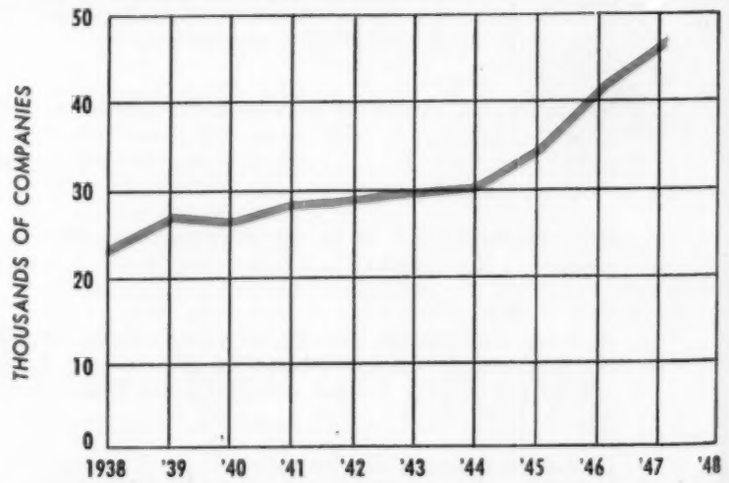
Price Increase To Be 5%

An important part of the anticipated hike will be revealed when

METALWORKING COMPANIES HAVE DOUBLED SINCE 1938

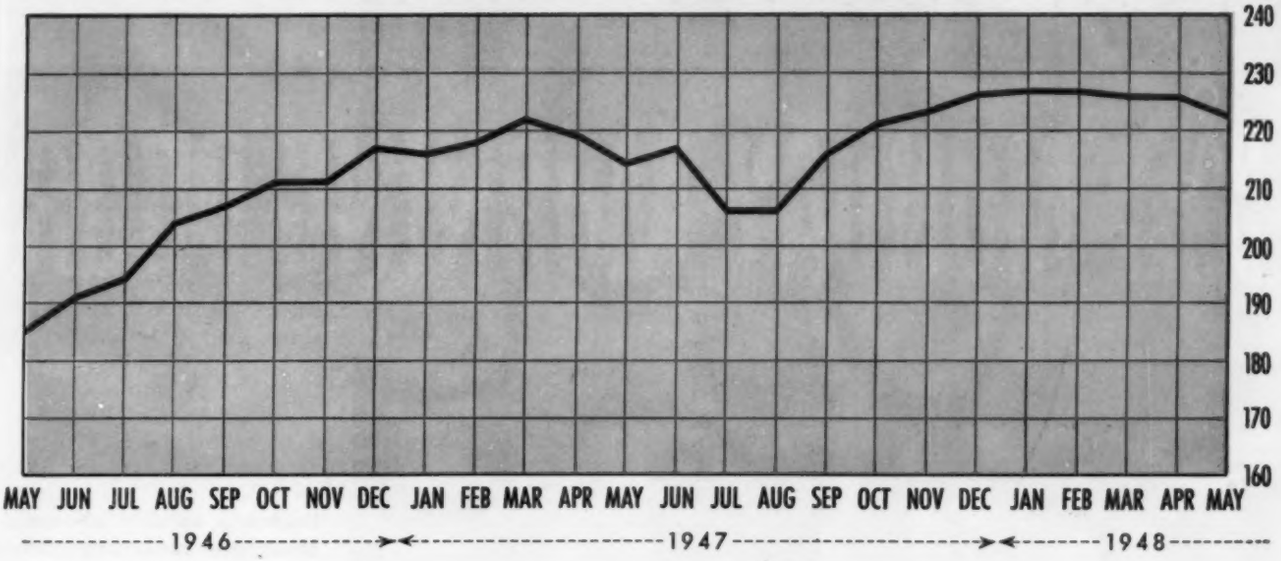
	ALL COMMERCIAL AND MFG. COMPANIES	ALL MFG. COMPANIES	COMPANIES MAKING METALS & METAL PRODUCTS
1938	3095.3	195.5	21.8
1939	3246.4	214.0	26.0
1940	3292.2	215.5	25.9
1941	3300.8	222.8	28.3
1942	3229.0	224.7	29.8
1943	2904.4	227.2	30.0
1944	2888.1	233.2	31.3
1945	3076.8	250.0	35.9
1946	3475.0	286.7	43.8
1947	3795.6	316.3	49.8

SOURCE: DEPARTMENT OF COMMERCE



Number of metalworking companies has risen from 22,000 in 1938 to almost 50,000 today. Other businesses do not show comparable gains.

American Machinist INDEX OF METALWORKING PRODUCTION



INDEX	COMPONENTS				
	MACHINERY	ELECTRICAL MFG.	AUTOS, TRUCKS	TRANS-PORTATION EQUIP.	OTHER METAL-WORKING
MAY 1948..... 222	251	229	225	289	144
APRIL 1948..... 226	249	237	228	303	153
MAY 1947..... 214	241	223	205	307	148

AMERICAN MACHINIST'S INDEX OF METALWORKING is based on manhours worked in five segments, which are "weighted" as follows: Machinery, 32.5—Auto & Trucks, 22.6—Electrical Manufacturing, 15.4—Transportation Equipment, 12.4—All Other Metalworking, 17.1 Index figures are a percentage of 1939, which equals 100.

steel advances are announced. The advance is expected on individual products. No general increase is anticipated.

Price gains in industrial lines this year probably will average about 5%. In contrast, 1947 saw the index of wholesale prices of all commodities, except farm products and food, move up from 124 to 146.

A price study made by an outstanding metalworking manufacturer shows that today it is paying 2½% more for all the commodities entering into its products than at the beginning of the year. Of the 60 commodities used by this company, prices on 32 held steady in June, 14 increased and 14 declined.

Mills Make Large Allocations

Steelmakers who must make price decisions will have no worry about demand. With operations around 96% of capacity, the industry will turn out 7 million tons of raw steel in June. That will make the total for the first six months around 43 million tons. The coal strike lopped off 2 million tons from the expected total of 45 million tons.

Steel mills, cooperating with the government, are continuing to cut into the present inadequate supply of sheet steel by making further voluntary allocations to specific programs. Examples: 160,000 tons to the atomic energy program and 212,000 tons to the home construction industry. These allocations are on top of those already made to the freight car program and European reconstruction.

One large steel consumer estimates that it will pay substantial premiums for almost half of the sheet steel used in 1948. Reason: much of it comes from "conversion" arrangements and some of it from substitution of higher-grade steel because lower-grade items are not available.

Stainless Steel Sales Spurt

Hot-rolled carbon steel bars are short, partly because much tonnage is being channeled into cold-finished bars. But even cold-finished bars are tighter than they were two months ago. Alloy bars are extended in delivery and a few mills are allocating them.

Stainless steel companies report huge orders for bars and billets for aircraft purposes.

Several pig iron producers have increased prices $3 a ton. The pig iron situation is no better, with users struggling to maintain their stocks at a reasonable level

Aluminum Getting More Critical

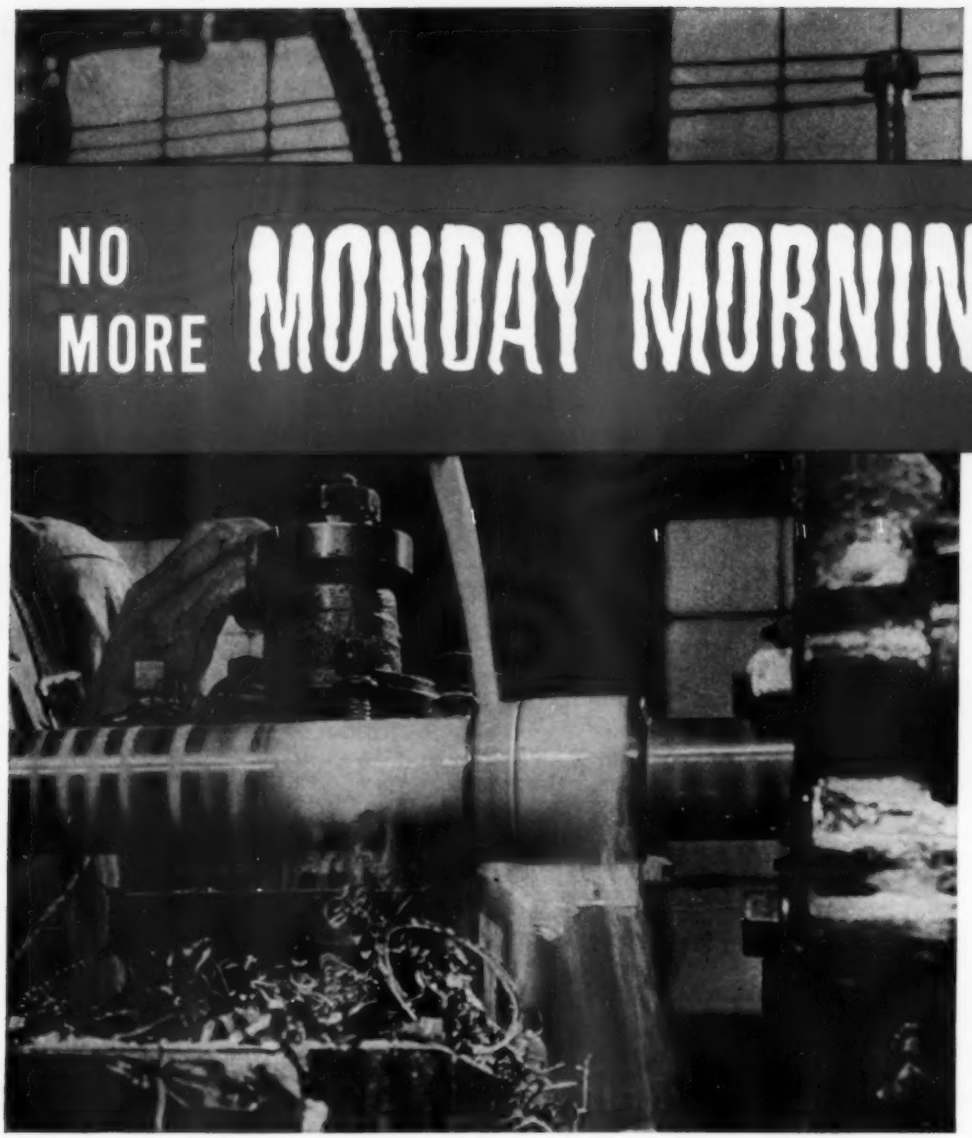
Supply of aluminum will reach the most critical stage this summer. It is believed that by midsummer all reserves of aluminum pig and ingot will have been consumed and from then on producers must rely on current output to supply customers' needs. The only outside help will come from Canadian imports.

Plane requirements will not be entirely superimposed on present consumption, because some aluminum has been going into military planes for some time.

Employment Sets New Record

Employment perhaps is the best gage of all metalworking activity. Personnel men confirm the tightness in the labor market during June, when new records are believed to have been set. How impressive postwar figures are is shown by a Census Bureau report: on the third anniversary of V-E Day, employment was 5 million higher than at the end of the European War.

The number of civilians at work in May were 58.6 million. Unemployed dropped to 1.8 million.



NO MORE MONDAY MORNING ODOR*

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Texaco Soluble Oil emulsions remain stable...do not develop disagreeable odors.

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Use *Texaco Soluble Oils* to make working conditions more pleasant for your operators . . . to increase your machining efficiency and lower your costs. A Texaco Lubrication Engineer will gladly give you full details.

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American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

The Personal Element

Just what is it that cements employee-management relationships so that no strikes have occurred in a company during its lifetime of more than forty years?

We attempted recently to find out from the officers of a company with such a record. After a long session, we were not quite sure.

It wasn't until a few days later that we got the answer. The tipoff came when we made a leisurely tour of the entire plant with the president.

Here was the head of a company who made it a practice to be out in the shop a part of every working day. He talked with numerous employees and nodded in friendly fashion to a great many more.

He knew every detail of the product which the men were making. He was familiar with shop practices and their ramifications. He wasn't afraid to get his hands dirty; and he could run almost any machine in the plant himself.

Many of the employees he knew by their first names. They were friends as well as workers.

Sure, he had an elaborate employee welfare setup, like a lot of other companies. But that alone did not explain the loyalty of his men and the amazing record of no work stoppages in a community which had experienced many strikes.

"The boss" was available to all his men. They knew that he loved the shop and liked to work in it himself. He was no stuffed shirt. If they had grievances, as they naturally did at times, they always were settled fast.

The sons and other lieutenants of the boss grew up with him and took their cue from him. No top man in the company has lost sight of the personal element in dealing with employees. The men in the shop are treated as though they were partners in the business. There is no mawkish sentimentality about it, however.

After seeing a practical man-to-man relationship of this kind at work, we would be less than human if we didn't ask, "Why can't this sort of thing be done by thousands of companies?"

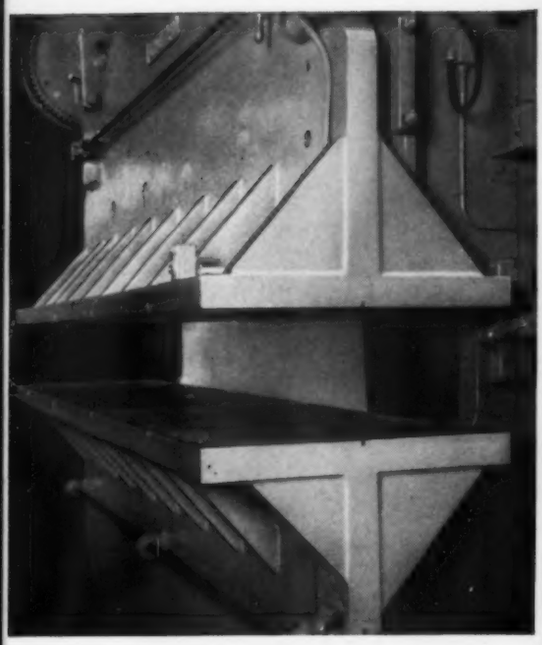
To be sure, the personal element which the president of this company and his staff have injected into the relationship with employees cannot be achieved in a large manufacturing organization with thousands and thousands of workers. The "brass hats" cannot be expected to know everyone in a far-flung operation.

But let's remember that the bulk of America's metalworking companies employ 500 employees or less. A much larger ratio employ 1000 workers or less. In companies of such size, the achievement of a fine personal relationship between the "front office" and the men at the machines is possible.

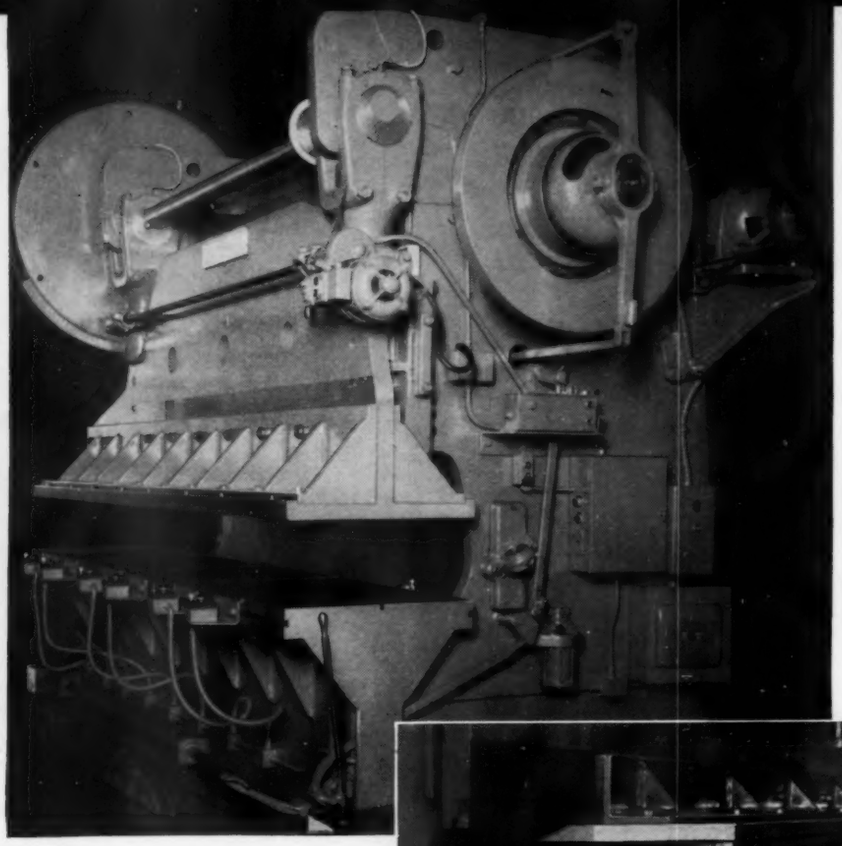
It is, in fact, more than possible. It is essential if individual companies and industry as a whole are to attain the teamwork necessary to operate efficiently and at the lowest possible cost in these days of spectacularly high prices of materials and labor.

Burnham Finney

EDITOR

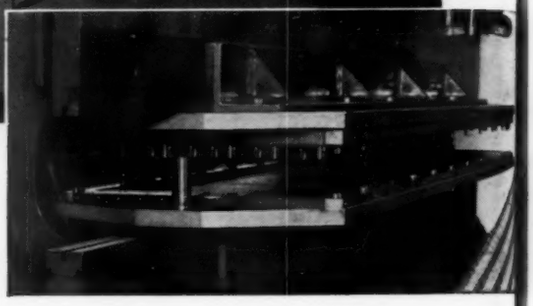


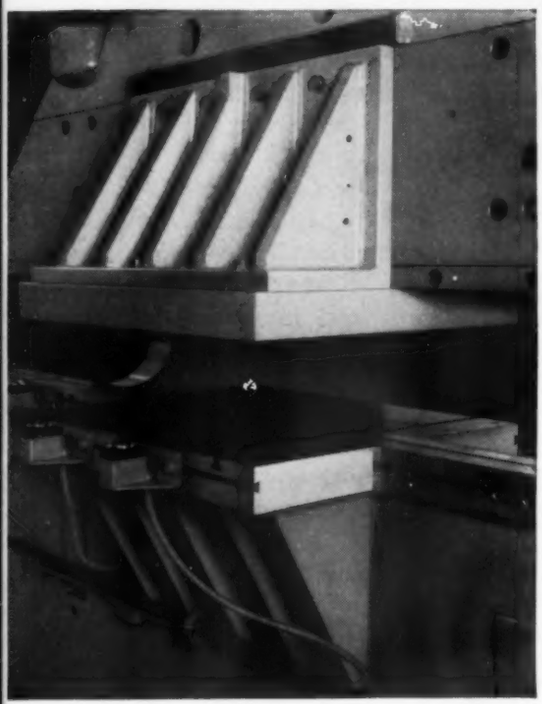
Large area, permanent wide bed and ram for press work



Large area, removable upper brackets

Large area, removable upper and lower brackets





Short, special purpose, removable upper brackets

JUMBO DIE AREAS...

on CINCINNATI PRESS BRAKES

With Cincinnati wide rams and beds, Cincinnati Press Brakes are now being used for both PRESS and PRESS BRAKE work.

These wide rams and beds are of two basic types—the permanent type for Press work only; the removable bracket type for general purpose requirements. With removable brackets, Cincinnati Press Brakes are dual purpose and function as Presses but also retain all the versatility of a Press Brake.

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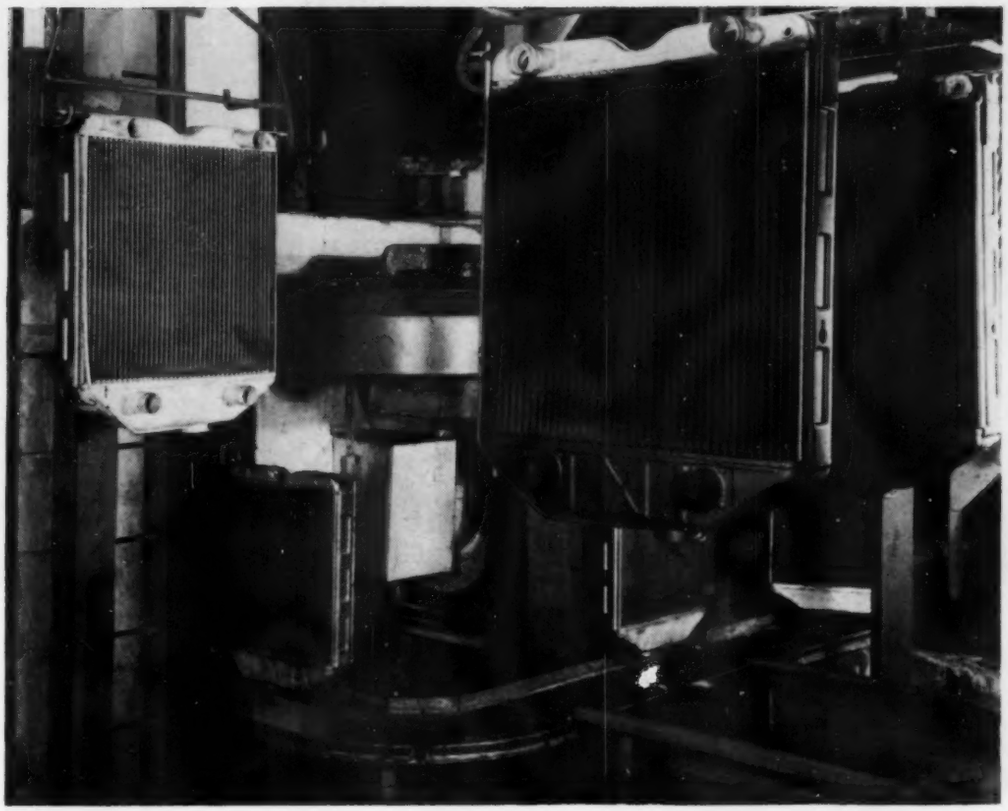


Completed radiators emerge from two-level baking oven where paint is dried at 220 F. Continuous conveyor carries the cores through the final cleaning, drying, painting, and baking operations

FORD'S RADICAL RADIATOR PRODUCTION LINE

1949 Ford radiators operate on the same principle as the old ones. That is about where the similarity ends, for redesign of parts, processes, methods, and machinery has developed a mechanized method of making this product that — even in the auto industry — has usually been assembled on a bench

By CHESTER S. RICKER, DETROIT EDITOR

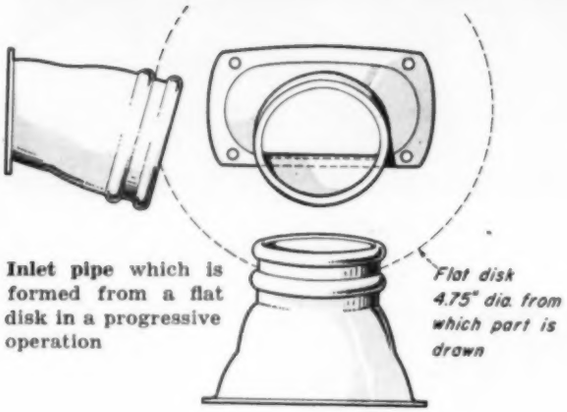
BETTER mechanization and handling methods appear at first to be the principal changes in the method of manufacturing radiators at the Ford Motor Company, but there has been much more improvement than this indicates. The 1949 Lincoln, Mercury, and Ford automobile and Dearborn tractor radiators are now being produced on a completely mechanized assembly line at the Rouge Plant, according to Mead L. Bricker, vice-president and director of general production.

Processes are as fully conveyorized as possible with basic methods retained but rearranged, simplified, and mechanized to provide a straight-line flow of parts to subassemblies and final assembly, testing, inspection, painting, and shipping.

Radiator inlet and outlet tubes require ten operations on a brass disk 4¾-in. dia. and 0.034 in. thick. Formerly, the manufacture of each of these units required five separate press operations with three annealing cycles alternating between the drawing operations. Now they are all finished on one machine, a Hilo press, which has ten operating stations through which the pieces progress step by step. When finished they drop onto a metal conveyor belt and are carried through an annealing furnace to be normalized and stress relieved.

Blanks are in disk form, having been punched out of the strip prior to their introduction into the forming press. The disks, not being on a strip, are advanced from one station to another individually

Progressive 10-step operation on Hilo press forms inlets and outlets, replacing five separate press operations and three annealing cycles. From the press, parts go through a continuous furnace for annealing and stress relieving



Inlet pipe which is formed from a flat disk in a progressive operation

FORD RADIATOR

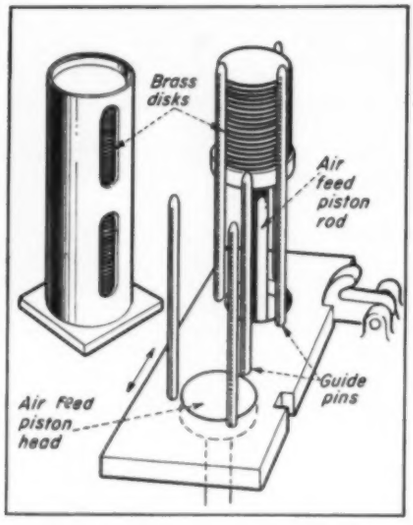
(continued)

by a shuttle mechanism. The only scrap that has to be taken care of is that when the attaching flange is sheared to size and the top outlet opening is punched out.

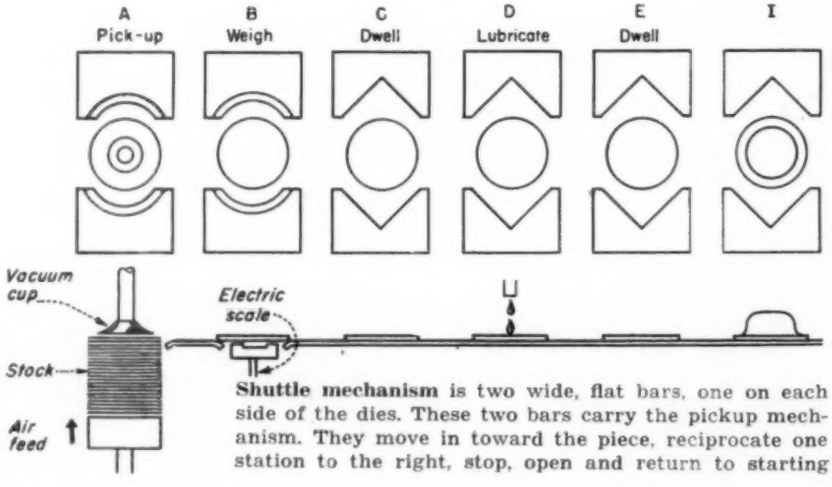
Tanks Are Pinch Trimmed

Making top and bottom tanks for the radiator is done on double-crank presses so a pinch trim die can be used, dispensing with the trimming operation which normally follows forming. This die leaves a slightly rough edge, but dimensionally and practically it is of no consequence because it is covered with solder eventually. It may even improve the soldering bond.

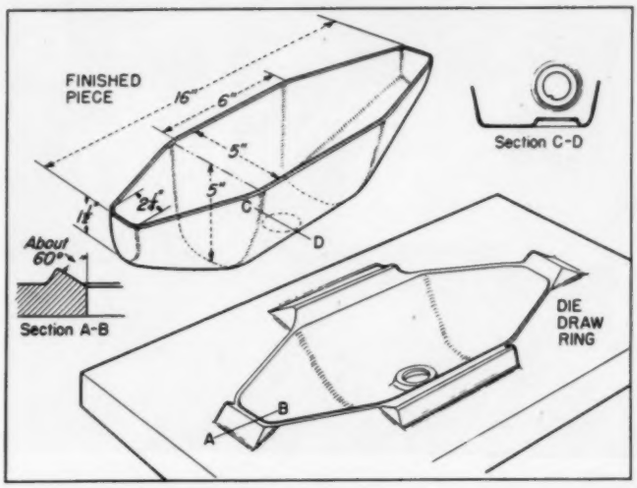
The water tubes are flattened in the machine which forms them from thin, coiled strip. The seam



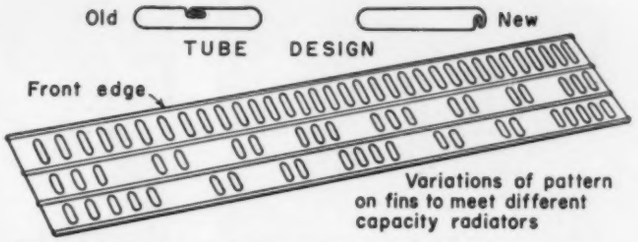
Two fixtures transfer brass disks from the punch to the Hilo press. Disks drop from press into container at left from which they are transferred to two-station loading fixture. They are dumped inside guide pins of idle station. At operating station disks are fed upward by air-operated piston, taken off one at a time by a vacuum-cup device



Shuttle mechanism is two wide, flat bars, one on each side of the dies. These two bars carry the pickup mechanism. They move in toward the piece, reciprocate one station to the right, stop, open and return to starting



Pinch trim die makes the top tank pressing. The width of the beveled band which goes all around the punch hole varies the clamping pressure and pinches off the flash when the piece is formed



Fewer leaks in water tubes should result from a new design which puts the crimp in the end of the tube instead of the side (upper left). Below this is an example of how the number of tubes is reduced in smaller capacity radiators. This effectively reduces the amount of copper and solder required

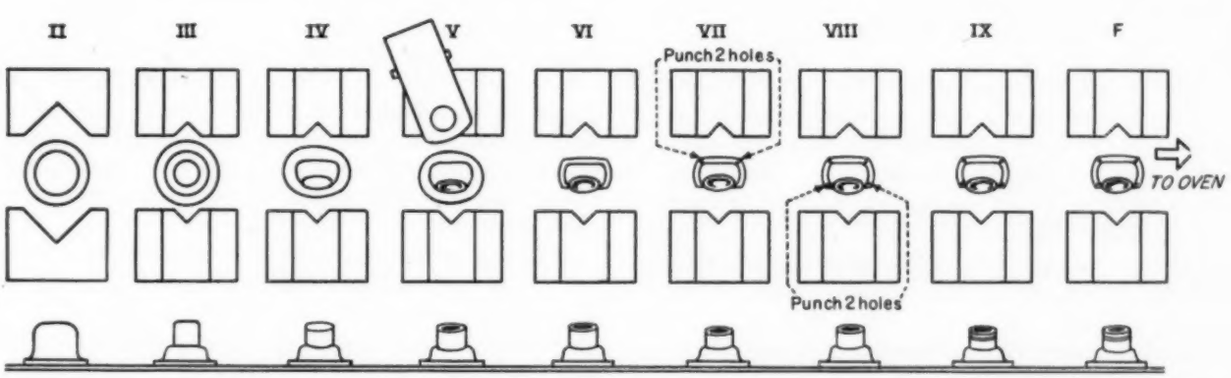
is locked during the process, and the entire tube soldered and tinned on the outside before it is cut to length on the fly. Also the end of one strip of stock is joined to that of the next while the machines are running so that tube forming is a continuous operation. At the present time each machine makes about 120 ft. of tubing per minute.

Cooling Fins

Cooling fins, which are 3⅛ in. wide and 0.0035 in. thick, are now being made on Ferracute P-4 presses. These presses form two fin strips at the same time. Beads are rolled in them prior to perforating. All tube holes are punched at one stroke and the fin is sheared to length at the same stroke. It is interesting to note that it is necessary to segregate the fin strips made from each press. Only in this way will the tube holes line up perfectly and delays in assembly be reduced to a minimum. Trimming the corners of these strips also makes them less vulnerable to bending during assembly.

Several other new developments have been made

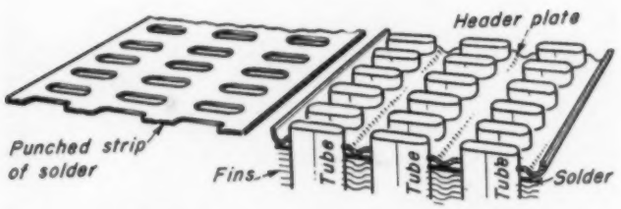
Radiator tubes are produced from flat stock at 60 per minute on this Ford-designed machine. Tubes emerge from the machine which forms and flattens them (locking the seam in the process) are immediately tinned and soldered, then cut to length on the fly by the machine in the foreground



position. Weighing operation at station **B** prevents feeding more than one disk at a time. Operations I, II and III are drawing. At IV, the piece is bent to one side. At V, the top hole is pressed and the punched out disk is dropped into a pan which reciprocates in and out to catch these punchings. At VI, the flange is trimmed to finished size. Two rivet holes are punched at VII and two more at VIII. At IX, the outlet is embossed

Swaging machine designed by Ford engineers swages the protruding ends of the tubes at top and bottom of the stack of fins. They establish the distance between header plates and thus the finished radiator height

Lead-covered fixture for fluxing cores. Cascade weir can be seen behind right-hand core. Radiators rock down into a horizontal position to pass under the cascade, then back upright to drain



Radiator assembly in section shows how the solder strip and header plates are assembled on the cores. A new method is contemplated in which the solder will be flowed onto the header plate before punching

FORD RADIATOR *continued*

in construction of these radiator cores because four sizes of radiators are being made on one assembly line. Where possible, the same machines and the same parts are used for all radiators, but there are modifications in the number of tubes in different models. Radiators are being built on this line for engines varying from 25 to 150 hp. All machines are designed for three rows of tubes, but the spacing of the tubes varies to suit the cooling needs of each engine.

Radiator cores of substantially the same dimensions may be quite different in their cooling capacities. On the final assembly line they may also take different outlets and connections. To guard against assembly errors or delays, a color scheme indicates which radiator is which. On the final assembly line, targets of the same color are attached to each fixture and guide the workmen in selecting the proper fittings.

In the past it has been customary for each operator to assemble a complete core. That is, he aligned all of the fins in a fixture and then inserted all of the cooling tubes by hand. When the new assembly line is completed each man will only put in a few fins as the fixture, on a waist-high conveyor, passes his station. The next man puts in more fins; when all fins are in, the fixture passes to the tube men where each will put in a certain number of tubes at his station. When the assembled radiator cores reach the end of the line, they are combed to make sure the fins are in proper shape, and then put on a rotary fluxing fixture.

The fluxing fixture is a nine-station rotary unit that has lead-covered core holders which pass under a cascade of fluxing fluid. This thoroughly prepares the tubes and the fins for soldering. When a radiator leaves the fluxing fixture it is put on a chain-driven merry-go-round that conveys the core through an Industrial Heating Equipment gas-fired oven. Here the cores are baked at a temperature of 580 F. during a 6-min. cycle.

Heads Swaged in Place

The sweated core goes to the swaging machine where solder washers and top and bottom headers are pressed on to the ends of the water tubes. The double-ended machine establishes the exact height of the core and eliminates measuring and a lot of fitting and rework later on. The solder washers are a punched ribbon of solder 0.025 in. thick and 2¼ to 3 in. wide. They are exactly the same length and shape as the header to be sweated. The excess solder drips off the core during the automatic soldering operation and is all caught in a gas-heated trough which drains into a crucible container so none of it is lost.

When the headers are in place, the cores are picked up on an adjustable conveyor fixture and passed through a new automatic soldering oven. This is gas-fired and completely eliminates manual soldering or dipping. The radiators are supported in forked holders which allow them to incline toward the soldering flame which is of the soft, low-pressure, multiple-burner type. It is arranged with a long, inclined row of burners which first heat the

top corner of the radiator header, and then as the chain conveyor pulls them past it, gradually moves the hot section downward until the lower corner of the headers is soldered. Directly beneath the lower corner of the cores, there is a gas-heated V-trough into which excess solder drains. The core carrier is pivoted at the center and guided by rails so that when one side has been completed the radiator is rocked over at the same angle in the opposite direction. On the other side of the oven there is a similar inclined bank of flames for soldering the other end of the core. It only takes about 6 min. for a radiator core to pass through the oven.

Final Assembly Line

The cores, when they leave the soldering oven, are put on special adjustable fixtures mounted on another merry-go-round conveyor line. There are 15 hand operations on this line before the finished radiator is ready for inspection. The fixtures on this conveyor allow the radiator to be rotated to any one of eight positions while it is either vertical or horizontal. These fixtures eliminate bench damage which previously caused much rework.

The top and bottom tanks, side-wall supports, overflow pipes, and other fittings are hand soldered and aligned on the radiator core while it is carried in this assembly fixture. Adjacent to the proper stations on this assembly line are rotary soldering fixtures where sub-assemblies are made, such as soldering the filler opening into the top tank. These rotary units are loaded and unloaded by one operator. The actual soldering flame is at a point removed from the operator, who puts the parts together as he loads the fixture.

The merry-go-round moves at about 19 fpm. There are a few stationary fixtures along the line near the finish so that the line itself is not held up when small salvaging operations have to be carried out. These run about 1/3 of 1% at the present time.

When the radiator has been completely assembled, it is put on an over-head conveyor that carries it to the testing tanks. Twin tanks are used so that one radiator assembly may be tested while the other is being corrected. Rubber stoppers are put into the outlet openings, one of which carries air so that air pressure can be applied to the inside of the core while it is dipped in the water.

Make Own Solders

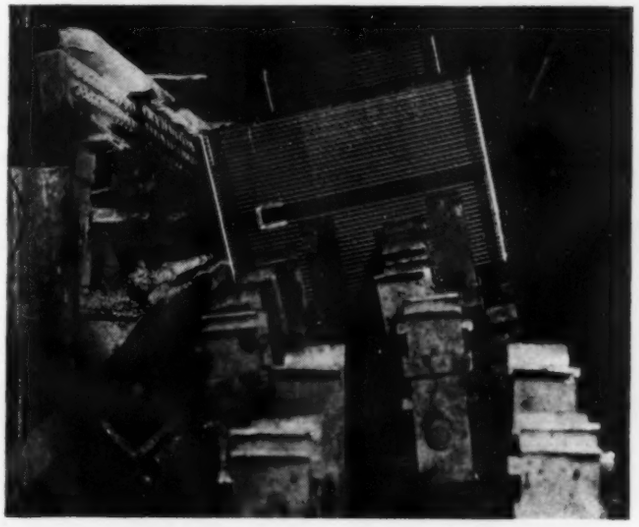
After inspection and correction, the radiators are conveyed through hot and cold washers to neutralize any acid left on the cores and radiators. They are then carefully dried in an oven, because moisture on the inside of them is just as serious as moisture on the outside. When dry, they pass an automatic spray system which paints them with dull black enamel. Then they go into a convection-type gas-fired oven and are baked at 220 F.

Because of strict allocation of tin and lead, Ford buys all basic metal in the pig and alloys its own solder formulas. Some parts require a 25-75% alloy, others a 40-60% alloy. They have found it convenient to make these mixtures themselves, then extrude the solder through dies to the diameter they require. Hydraulic pressure is used to operate these extrusion presses.

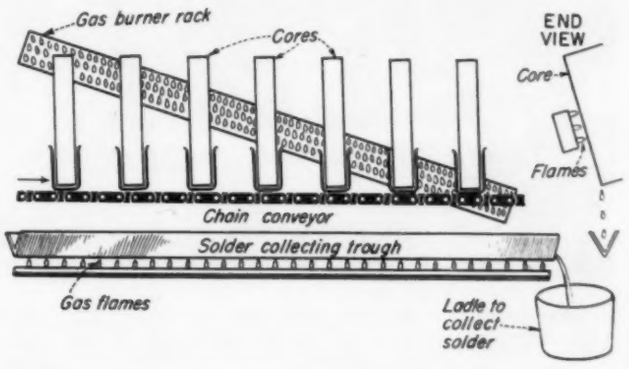
Another development which is under way and may be in full operation by the time this story is printed is putting the lock seam on the end instead of the side of the water tubes. This makes it possible to use a new machine, now being installed, which is expected to greatly exceed the speed at which tubes are now being produced. This also improves quality with less tube leaks in manufacturing.

A new fin-punching machine is planned that has four times the rate of production of the current machines.

Conveyorizing, improving old processes, providing automatic feeds, using entirely new methods, eliminating bench operations, and automatic soldering are a few of the new processes, designed to improve the quality, reduce the physical effort on the part of the workers, and eliminate damage due to manual operations, that have increased the production per man and per unit tremendously.



Automatic soldering oven through which cores pass after headers and solder machines have been swaged in place. A solder-catch trough salvages the solder that drains off



Burner rack in soldering oven is placed at an angle, heats the top of the core, then, in a narrow band, solders it to the bottom. Core is then tilted to the opposite angle and a second burner rack solders the other end

Table-welding jig for base assembly. Air-operated hold-down clamps are visible near corners. Auxiliary jig in left foreground locates rocker arm

Cross-braces are held by hand against fixed stops for tack-welding to base. Air clamping cylinder is visible at center of jig

Precision Welding Jigs Simplify Stove Assembly

Use of war-learned techniques of lofting and high-precision jigs for welding solves many problems for Odin Stove Co.

BY WALTER RUDOLPH

PLANT-FABRICATED jigs that hold resistance-welded components to lofted dimensions are important to straight-line production of precision-built gas ranges at Odin Stove Mfg. Co., Erie, Pa. Major parts of the range chassis, such as front, center and side frame, drawer rails and base assembly, are welded within 0.006 to 0.007-in. tolerances on a mass-production basis.

Welding gives rigid chassis construction, preventing weaving of the frame and virtually eliminating craze, cracking and chipping of porcelain-enameled parts. Almost perfect alignment is obtained, doing away with strain on the porcelain that literally hangs on the chassis.

By maintaining such close tolerances on the various jig welding operations, lost time on final assembly-line movement is avoided. Parts do not fit together stubbornly, nor loosely, and ranges move smoothly to packaging.

Lofting, thought to be unusual in range production was carried over from the accuracies, precisions and methods learned by Odin during aircraft, rocket, and Navy constructions of the war. Reconversion included a complete

plant overhauling to tie in this procedure with departmentalization, precision fabrication and conveyorization of much of the work.

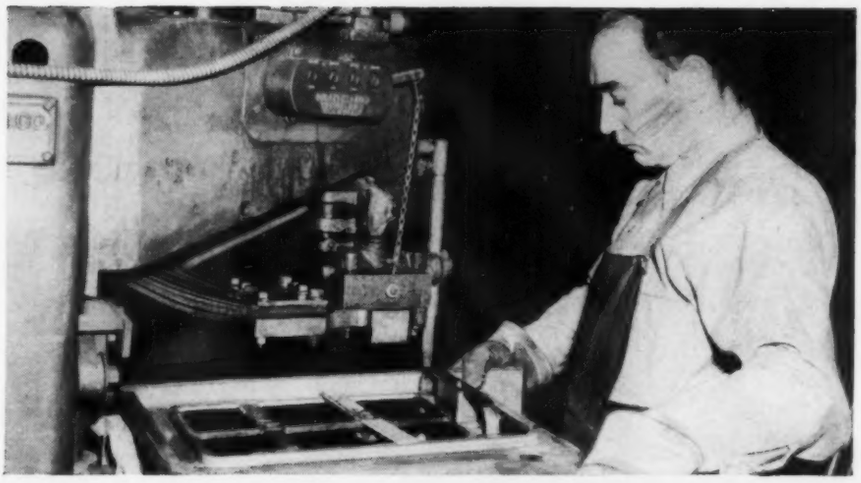
Sheared steel templates are made from the lofting-table specifications, and plant departments figure out from templates how pieces will be manufactured. Jigs are then fabricated by the toolroom to produce the pieces to lofted dimensions, and each fixture is minutely inspected to maintain precision.

The chassis or frame of the range is of rolled steel sections carrying slots or grooves across the front and top. Flanges of the manifold cover, sides, one-piece oven lining and one-piece main cooking top simply slide into these slots. Fit of the flanges into the slots leaves plenty of room for expansion and contraction of all parts. Only nine bolts are necessary in this construction, to hold on the back in the back-to-the-wall range.

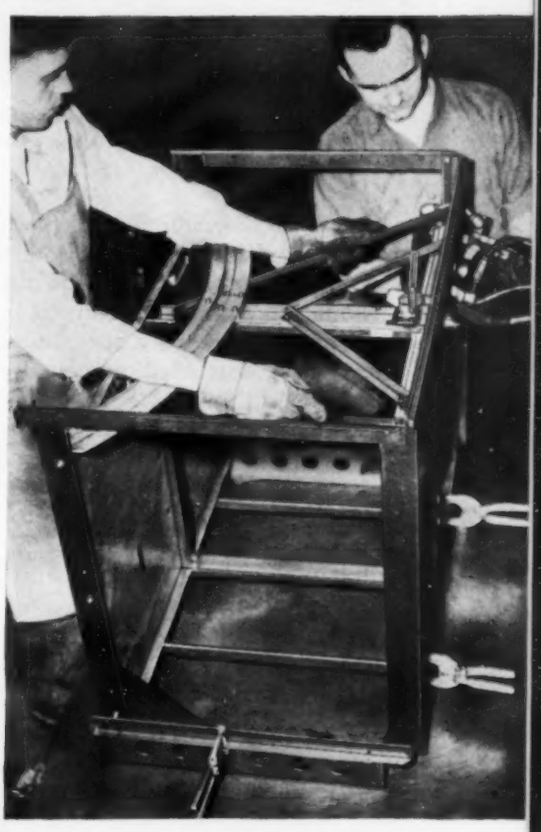
Much experimentation was necessary to develop jigs that fitted efficiently into welding procedures on the chassis components. One of the most elaborate of these is used in the range base assembly. Cold-rolled, perforated steel strips go through four operations in the press department and are then moved to the welding department. Here the pieces are fitted into a table jig designed to hold everything square to positive stops and precision locating posts. A three-way air valve admits air at 100 psi. into a cylinder with a 3-in. bore and a 6-in. stroke. The piston activates four hold-down arms that move in sections of 1-in. pipe attached to the sides of the jig, holding the pieces rigid for welding. This table is an all-welded fabrication of 2-in. angle iron, ⅜-in. thick.

A special small fixture on the side of the table jig adjusts the position of a rocker arm placed by a worker, and the arm is tacked into place before the finish welding. Other subassembly pieces, such as base pads and center rails, also fit into place against precision stops and are welded. Water-cooled hydraulic guns, suspended from a monorail for greater freedom of movement around the work station, are used for welding.

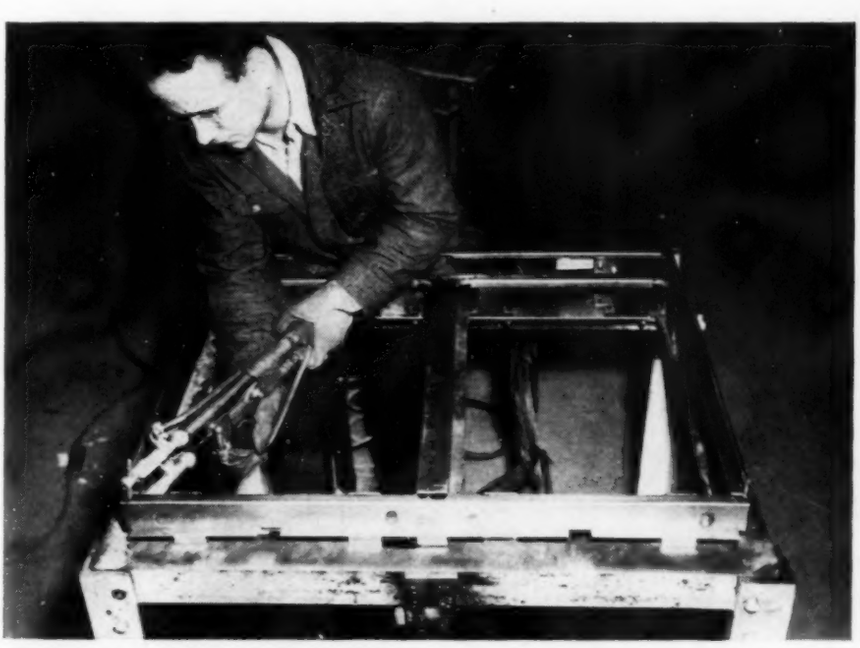
When welding is completed on the base assembly, the air valve is tripped to power ejector pins that



Burner hangers are spot-welded to the stove top on a special jig which holds the hanger in position. Aluminum reduces the weight of the jig and makes work easier



Aluminum squaring jig holds chassis true while angle braces are tacked into position. Base is squared up on a table and held to chassis by toggle clamps



Spot-welding the front frame is performed on a second table jig. Water-cooled welding guns are fitted with special electrodes adapted to reach into all corners

Oven compartments are formed on this air fixture that bends the sheet around a fixed block. Sides are clamped on and tack-welded about every 1½ in. around the periphery

are part of the clamping devices, moving in reverse. These ejectors kick the assembly free of the jig.

Numerous small jigs are used in the many subassembly operations. They are constructed principally of aluminum, for lightness. Pieces of stretcher rail are used for the jig body, and are welded to close dimensions. Oven normalizing is used to relieve strains, and the body machined as required. Locating pads, pins and clamps are doweled and screwed into place, and copper pads are inserted at welding points.

Utilizing these small jigs, clamps, and locating holes, much of the subassembly work is done from a surface plate setup. The jigs holding the pieces, are carried to fixed welding machines with specially adapted welding heads and tips. Although many electrodes are used as they come from vendor, the engineering department at Odin has developed special electrodes to bring tips into effective position for difficult welds.

An ingenious trolley arrangement is used in one instance to speed welding of the front frame. On a table near the machine, the component parts are fitted into the jig. This weighs 33 lb. when loaded, and to transfer it into the welding machine it is attached to two hooks on pulleys running along a wire just in front of the machine. After welding the assembly is pushed back to the table for unloading.

Subassemblies of front and side frames, etc., converge upon a work table where two men fit eleven No. 10-24 bolts and nuts into previously punched holes to hold the components together for finish welding the chassis onto the base. Two other men set the bolted chassis into the base on a nearby surface plate. A special aluminum jig fits into the top of the chassis to hold it square while braces are tacked in, and toggle clamps are placed around the assembly before finish welding with a portable machine. After welding the clamps are removed, the chassis carried to a fixed machine for a few more strengthening welds, and the frame is ready for movement to the cleaning and dipping room.

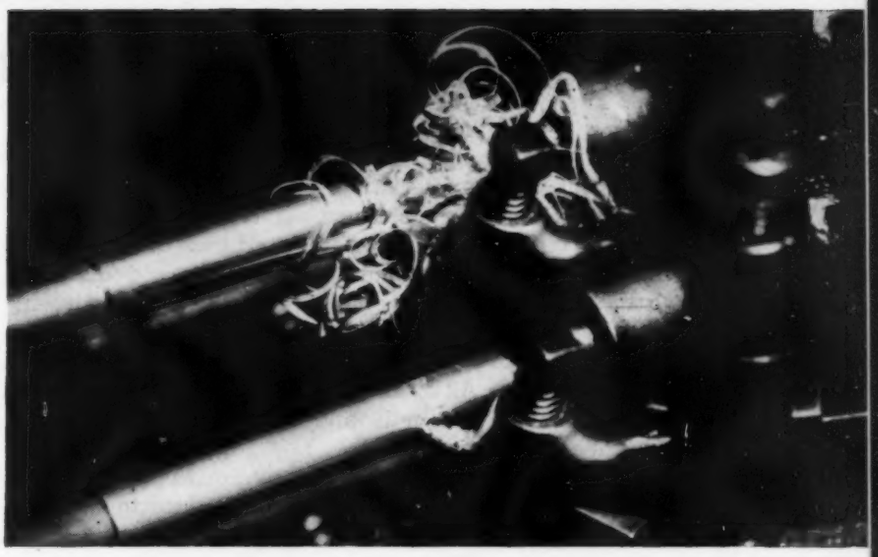
Tips FOR TOP SHOP MEN

239 No job is ever too rush for "please"; no good job too trifling for a compliment. It's easy to criticize, but even justified criticism can only be stomached if it is balanced by earned praise.

240 Politics is everyman's business—but yours. As an individual you can discuss politics as much as you like, but danger lies in the probability that your men will assume you are trying to use your position to enforce your way of thinking on them. And . . . are you *sure* you aren't?

241 Be on the watch for the man who can be accurate—and brief, when he describes a job. He's good "boss" potential; because explaining is half the battle.

"Everything mechanized—that's our motto."



Contrast in machinability of aluminum alloys. The gummy alloys produce continuous chips that cause trouble; the newer free-cutting alloys produce chips that break up easily

How to Work

ALUMINUM and its ALLOYS

BY ANDERSON ASHBURN, ASSOCIATE EDITOR

Aluminum is the postwar success story. Shipments today are at a rate seven times the prewar average. In volume, aluminum is the most widely used non-ferrous metal. Even though fabulous capacity was created during the war, the demand is now taxing the facilities which are commercially practical for peacetime operation.

Granted that the shortage of steel has been a major factor in creating demands for aluminum; granted that the consumption is small compared with that of iron and steel—the fact remains that aluminum now has about 4000 commercial uses. For most of these it is so well suited that it will stay even when steel becomes plentiful.

The price of aluminum is one of the few things that has remained constant in recent years: aluminum pig is 14 cents a pound. The aluminum industry is intensely competitive and there is reasonable assurance of adequate supply at minimum cost. This has encouraged firms previously cool to the metal to investigate the possibilities of aluminum for their own products.

What they find is a metal of unusually light weight and good corrosion resistance made into alloys of high strength. They find that there have been important developments in both alloys and methods in recent years. Plants that consider aluminum and plants considering new applications will be especially interested in fabricating procedure. Much of the information on latest practice is summarized on the following pages.

INCLUDED . . .

1. **THE ALUMINUM ALLOYS** . . . alloying ingredients, nomenclature, strain hardening, thermal treatments, properties
2. **MACHINING METHODS** . . . tool design, tool materials, machine requirements, speeds and feeds, depths of cut
3. **SHEET-WORKING METHODS** . . . shearing, blanking and punching, bending, forming, drawing, spinning
4. **CASTING AND FORGING** . . . sand and permanent-mold casting, die and investment casting, forging, impact extrusion
5. **JOINING METHODS** . . . riveting, gas welding, arc welding, resistance welding, brazing, soldering, adhesives
6. **CLEANING AND FINISHING** . . . cleaning, etching, frosting, buffing, polishing, anodizing, plating, painting

A SPECIAL American Machinist REPORT TO THE METALWORKING INDUSTRIES

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1 THE ALUMINUM ALLOYS

Commercially pure aluminum has many desirable characteristics—light weight, pleasing appearance, formability, reflectivity, corrosion resistance, conductivity — but it lacks strength and hardness and is a gummy material that, despite its softness, is difficult to machine. Known generally as A2 or 2S, it is widely used when strength and hardness are not important.

The addition of alloying elements develops alloys with a wide variety of properties. In some cases these can be further improved by heat-treatment. Some alloys develop greater strength by strain hardening.

Most common alloying elements are copper, silicon, manganese, magnesium, and chromium. Others are iron, zinc, nickel, and titanium. The effect of alloying elements varies somewhat in different alloys; but, in general, the effect of some principal ones is as follows:

Copper improves strength, hardness and machinability, helps maintain properties at elevated temperatures lowers corrosion resistance, increases fluidity and hot-shortness.

Silicon increases fluidity, decreases hot-shortness, increases strength and hardness with a decrease in ductility. It makes the alloy hard to machine, but much of this difficulty can be overcome with carbide tools.

Manganese forms complex compounds with aluminum and iron which appear to result in the improved ductility and resistance to impact found in alloys containing manganese. Corrosion resistance is not impaired.

Magnesium tends to increase strength and hardness, results in good impact resistance and ductility, and maintains properties at elevated temperatures to some extent (though not as much as copper). In combination with silicon it increases strength and hardness but reduces ductility; in some of the other complex alloys it seriously impairs elongation and impact values. In combination with zinc it has a powerful hardening effect.

Zinc was considered an unsatisfactory alloying agent for most purposes until recently. It adds to strength and ductility and is an important constituent in ZG42 (75S) and R303 where it is used in combination with magnesium to form these high-strength alloys.

Nickel added to alloys helps to maintain properties at high temperatures. Small amounts of titanium in casting alloys, added at the foundry, act as a grain refiner.

In the complex alloys, changes of strength are accompanied by changes in other properties so that two alloys of equal tensile strength may differ widely in other respects.

Designations of alloys are largely arbitrary. In addition there are many different designations for the same alloy applied by different firms and organizations. Unfortunately no systematic means of designation has come into general use. The most promising are the ASTM designations. For this reason these designations are used whenever possible in this report with the producer's designation following in parentheses.

Tempers

A new method of temper designation for wrought alloys is a systematic combination of letters and numbers. Once learned the new system is easy to understand and is more informative than the old methods. Conversion tables are available from many sources which show both old and new designations. Temper is separated from alloy designations by a dash.

In one class of alloys, different tempers are produced by strain hardening. Three methods of strain hardening are designated H1, H2, and H3. Annealed tempers are designated by O. As fabricated is designated by F.

The degree of hardness is designated by the numerals 2, 4, 6, 8 which represent eighths of the hardest standard temper. Thus 2, is ¼ hard, 4 is ½ hard, and 8 is hard.

H1 tempers result from strain hardening after an annealing operation introduced at the proper point in the reduction process. H2 tempers result from strain hardening to a harder temper than desired, then partially annealing to the desired hardness. H3 tempers are obtained only in certain alloys that do not normally reach stable conditions for some time after strain hardening. They can be stabilized in a few hours at elevated temperatures and the H3 tempers indicate that this has been done so no further change will take place on standing at room temperatures.

Temper designations for strain-hardened alloys are combined thus: 2S-H12, 2S-H22, 52S-H32.

Heat-Treatment

Annealing will remove strain hardening. Complete softening is practically instantaneous for A2 (2S) and GR1 (52S) at temperatures above 650 F. Longer heating at lower temperatures will produce similar results. For most of the heat-treatable alloys, annealing temperature is about 650 F. and must be carefully controlled. Some engineers recommend slow cooling to 500 F., after that the rate is not important. For a fuller anneal, alloys which have been heat-treated are held at 780 to 800 F. for 2 hr., furnace cooled at not more than 50 F. per hour to 500 or 600 F., then removed from the furnace for more rapid cooling.

The heat-treatable alloys can be solution heat-treated to improve their properties by heating to the proper range, then quenching. In this condition they are unstable, with the exception of 25S. The properties gradually improve over a period of time. In CG21 (24S) most of the change takes place in 2 hr. Aging of ZG42 (75S) takes several months. Holding the alloys at low temperatures retards or arrests age hardening. The unstable temper following solution heat-treatment is designated by W. The designation should include the time if any idea of the properties is to be conveyed, as 24S-W (20 min.).

TYPICAL CHARACTERISTICS OF SOME ALUMINUM ALLOYS

ALLOY NUMBER (cd = clad) | NOMINAL COMPOSITION, % | HEAT-TREATMENT

TYPICAL CHARACTERISTICS OF SOME ALUMINUM ALLOYS

	ALLOY NUMBER (cd = clad)					NOMINAL COMPOSITION, % (Alum. and impurities = remainder)								HEAT-TREATMENT				TENSION		ELONGATION (% in 2 in.)							RELATIVE CHARACTERISTICS						
														Solution[1]		Precipitation		M psi														
	ASTM	SAE	ALCOA	KAISER	REYNOLDS	COPPER	SILICON	MANGANESE	MAGNESIUM	OTHER	WEIGHT LB./CU. IN.	SOLIDIFICATION RANGE, °F.	TEMPER DESIGNATION[1]	TEMP., °F.	TIME, HR.	TEMP., °F.	TIME, HR.	ULTIMATE	YIELD	SHEET	CASTING	BAR	COMPRESSION YIELD, M psi.	SHEAR, M psi.	FATIGUE, M psi.	BRINELL	MACHINABILITY	COLD WORK	GAS WELDING	ARC WELDING	RESISTANCE WELDING	BRAZING	SALT-WATER RESISTANCE
WROUGHT ALLOYS	A2	25	2S	2S	2S	—	—	—	—	—	.098	1190–1215	O	—	—	—	—	13	5	35		45	5	10	5.0	23	B	A+	A	A	A	A	A
													H18	—	—	—	—	24	22	5		15	21	13	8.5	44	B	B–	A	A	A	A	A
	M1	29	3S	3S	3S	—	—	1.2	—	—	.099	1190–1210	O	—	—	—	—	16	6	30		40	6	11	7.0	28	B	A+	A	A	A	A	A
													H18	—	—	—	—	29	26	4		10	25	16	10.0	55	B	C+	A	A	A	A	A
	CG1	24	24S	24S	24S	4.5	—	0.6	1.5	—	.100	935–1180	T4	920	h	—	—	68	48	20		19	46	41	18.0	120	A	C–	D	C	D	X	C
	cdCG1	240	cd24S	cd24S	cd24S	4.5	—	0.6	1.5	m	—	—	T86	920	h	375	11–13	70	66	6			—	—	—	—	A	C	D	C	A	X	A
	CM21	26	17S	—	17S	4.0	—	0.5	0.5	—	.101	955–1185	T4	940	h	—	—	62	40	—		22	40	38	18.0	105	A	C	D	C	D	X	C
	CM41	—	—	—	R317	4.0	—	0.5	0.5	a	.102	—	T4	940	h	—	—	62	40	—		22	40	—	—	—	A	C	D	C	D	X	C
	CP21	—	11S	—	—	5.5	—	—	—	a	.102	995–1190	T3	—	—	—	—	55	48	—		15	44	32	18.0	95	A	C–	D	D	B	X	D
	CS41	260	14S	—	14S	4.4	0.8	0.8	0.4	—	.101	950–1180	T4	940	h	—	—	62	44	—		20	40	38	18.0	105	A	C	D	C	D	X	C
													T6	940	h	340	8–12	70	60	—		13	60	42	18.0	135	A	C–	D	C	D	X	C
	cdCS41	—	cd14S	—	cdR301	4.4	0.8	0.8	0.4	k	—	—	T4	940	h	—	—	61	37	22		—	38	37	—	—	A	C	D	C	D	X	A
	GR1	201	52S	52S	52S	—	—	—	2.5	c	.097	1100–1200	O	—	—	—	—	27	12	25		30	12	18	17.0	45	B	A+	B	A	A	C	A
													H38	—	—	—	—	41	36	7		8	36	24	19.0	85	B	C+	B	A	A	C	A
	GS1	—	63S	—	63S	—	0.4	—	0.7	—	.098	1140–1205	T5	—	—	450	1–2	30	25	12		—	24	18	—	65	B	B	A	A	A	B	A
	GS21	281	61S	61S	R361	0.25	0.6	—	1.0	c	.098	1080–1205	T6	970	h	320	16–20	45	40	12		17	40	30	13.5	95	B	B–	A	A	A	A	B
	ZG42	—	75S	75S	—	1.6	—	—	2.5	b	.101	890–1180	T6	870	h	250	22–26	82	72	11		11	72	49	21.0	150	A	D	D	C	D	X	C
	cd ZG42	—	cd75S	cd75S	—	1.6	—	—	2.5	b, n	—	—	T6	870	h	250	22–26	76	67	11		—	67	46	—	—	A	D+	D	C	A	X	A
DIE CASTINGS	S4	304	43	43	43	—	5.0	—	—	—	.095	1055–1155	AC	—	—	—	—	30	16		9.0		—	—	17.0	—	B	—	D	D	D	X	B
	S5	305	13	13	13	—	12.0	—	—	—	.097	1055–1090	AC	—	—	—	—	39	21		2.0		—	—	19.0	—	C	—	D	D	D	X	B
	SC2	307	85	—	85	4.0	5.0	—	—	—	.101	970–1155	AC	—	—	—	—	40	24		5.0		—	—	22.0	—	B	—	D	D	D	X	C
	SC7	308	380	—	—	3.5	9.0	—	—	—	.100	970–1090	AC	—	—	—	—	45	26		2.0		—	—	20.0	—	B	—	D	D	D	X	C
	SG3	—	360	360	—	—	9.5	—	—	—	.097	1035–1105	AC	—	—	—	—	44	27		3.0		—	—	19.0	—	B	—	D	D	D	X	B
SAND CASTINGS	C1	38	195	195	195	4.5	0.8	—	—	—	.100	965–1180	T6	960	12	310	3–5	36	24		5.0		25	30	6.5	75	B	—	C	B	B	X	D
	CS22	33	113	—	—	7.0	2.0	—	—	d	.104	950–1150	AC	—	—	—	—	24	15		1.5		17	20	9.0	70	B	—	B	B	B	X	D
	G1	320	214	214	214	—	—	—	3.8	—	.094	1075–1185	AC	—	—	—	—	25	12		9.0		12	20	5.5	50	B	—	B	A	B	X	A
	G3	324	220	220	220	—	—	—	10.0	—	.091	840–1150	T4	—	—	—	—	46	25		14.0		26	33	7.0	75	B	—	D	C	B	X	A
	S1	35	43	43	43	—	5.0	—	—	—	.095	1055–1155	AC	—	—	—	—	19	9		6.0		10	14	6.5	40	B	—	A	A	A	B	B
	SC8	322	319	—	—	3.5	6.3	—	—	—	.099	950–1120	AC	—	—	—	—	27	18		2.0		18	—	10.0	70	B	—	B	B	B	X	D
													T6	940	12	310	2–5	36	24		2.0		24	—	10.0	80	B	—	C	C	C	X	D
	SC21	322	355	355	355	1.3	5.0	—	0.5	—	.096	1000–1160	T6	980	12	310	3–5	35	25		2.5		29	30	8.5	80	B	—	A	A	A	X	C
	SG1	323	356	356	356	—	7.0	—	0.3	—	.095	1055–1145	T6	1000	12	440	7–9	33	24		4.0		24	27	8.0	70	B	—	A	A	A	X	B
PERMANENT-MOLD CASTINGS	CN21	39	142	142	142	4.0	—	—	1.5	f	.101	990–1170	T61	960	4	400	3–5	47	42		0.5		46	31	9.5	110	B	—	C	B	B	X	D
	CS4	380	B195	B195	B195	4.5	2.5	—	—	—	.101	965–1180	T6	950	8	310	5–7	40	26		5.0		26	32	10.0	90	B	—	C	B	B	X	D
	CS22	33	113	—	—	7.0	2.0	—	—	d	.104	950–1150	AC	—	—	—	—	28	19		2.0		19	23	—	70	B	—	B	A	B	X	D
	GZ1	—	A214	A214	A214	—	—	—	3.8	e	.096	1050–1180	AC	—	—	—	—	27	16		7.0		17	22	—	60	B	—	B	A	B	X	B
	S1	35	43	43	43	—	5.0	—	—	—	.095	1055–1155	AC	—	—	—	—	24	9		9.0		9	18	—	45	B	—	A	A	A	B	B
	SC1	—	A108	—	A108	4.5	5.5	—	—	—	.100	960–1140	AC	—	—	—	—	28	16		2.0		16	25	—	70	B	—	A	A	A	X	D
	SC8	—	319	—	—	3.5	6.3	—	—	—	.100	950–1120	AC	—	—	—	—	34	19		2.5		19	24	—	85	B	—	B	B	B	X	D
													T6	940	8	310	2–5	40	27		3.0		27	—	—	95	B	—	C	C	C	X	D
	SC21	322	355	355	355	1.3	5.0	—	0.5	—	.096	1000–1160	T6	980	8	310	3–5	43	27		4.0		27	30	9.0	90	B	—	A	A	A	X	B
	SG1	323	356	356	356	—	7.0	—	0.3	—	.095	1055–1145	T6	1000	8	310	3–5	40	27		5.0		27	—	—	90	B	—	A	A	A	X	C
	SN41	321	A132	A132	A132	0.8	12.0	—	1.2	g	.098	970–1030	T551	—	—	—	340	14–18	36	28		0.5		30	24	—	105	C	—	D	C	C	X	C

NOTES:

a — 0.5 lead, 0.5 bismuth
b — 5.6 zinc, 0.3 chromium
c — 0.25 chromium
d — 1.7 zinc
e — 1.8 zinc
f — 2.0 nickel
g — 2.5 nickel

h — Time varies with product, type of furnace, size of load, from 10 min. for thin sheet in salt baths to several hours for large work in air furnaces.

i — Work should be quenched as rapidly as possible, preferably in a large tank of cold water. Large sections may be quenched in hot water to minimize strains

j — AC means "as cast;" for other designations see facing page

k — Composition is of core, cladding is a corrosion-resistant alloy

m — Composition is of core, cladding is high-purity aluminum

n — Composition is of core, cladding is a 1% zinc alloy

Aging can be speeded artificially by precipitation heat-treatment by heating to the range 240 to 380 F. for several hours (exact temperature and time vary with different alloys). Artificial aging usually produces higher tensile properties than natural aging, particularly yield strength, but with loss of ductility.

Cold working after solution heat-treatment produces a substantial increase in yield strength, some increase in tensile strength and some loss in ease of forming.

The tempers obtained by various combinations of treatment of the heat-treatable alloys are designated by the letter T and a numeral. An additional numeral indicates a modification of a given treatment (thus T6 and T61 represent the same cycle but slightly different conditions). In the same way T6 represents different conditions for each alloy, but the same cycle.

Annealed castings are designated T2. T3 means solution heat-treatment followed by cold working. T4 means solution heat-treatment followed by natural aging until substantially stable. T5 means artificial aging. T6 means solution heat-treatment followed by artificial aging. T7 means solution heat-treatment followed by stabilizing (in this process precipitation heat-treatment is carried beyond the point of maximum hardness to control growth or residual stress, or both). T8 means solution heat-treatment followed by cold working and artificial aging. T9 means solution heat-treatment followed by artificial aging and then cold working. T10 means artificial aging followed by cold working.

Resistance to corrosion of some alloys is influenced by heat-treatment. Especially with CS41 (14S) and CG21(24S), slow quenching lowers corrosion resistance and makes the alloys susceptible to intergranular attack. Heating the alloy after solution heat-treatment has the same effect. Artificial aging tends to restore resistance.

2 MACHINING METHODS

Machining characteristics of aluminum alloys are generally good. Commercially pure aluminum and some of the alloys are soft and gummy, others produce long, stringy chips that will foul the tool or machine and (because they have work-hardened) scratch the work. But many of the alloys now available can be cut at high speed, produce small chips, can readily be machined to smooth surfaces, and give long tool life.

The softer alloys sometimes build up on the cutting edge of the tool. This can be minimized with the proper cutting oil and highly polished tool surfaces.

Aluminum "springs" more under load than steel. This means care is necessary in clamping or chucking the work to avoid distortion.

The thermal expansion is about twice that of steel—a good rule is 0.0001 in. of expansion for each 8° F. When dimensional accuracy is important, overheating is kept at a minimum with sharp, well-designed tools, a coolant, and feeds that are not too heavy. Even so it may be necessary to make a thermal allowance in measuring.

Aluminum has a high coefficient of friction with steel. Tool surfaces must therefore be highly polished and free from scratches. When difficulty is encountered in machining aluminum it is perhaps most often the result of attempting to machine with tools polished as they would be for steel.

In general, tools have more rake than for steel, with additional space for chips. Tools should be designed so that chips and cuttings are directed away from the finished work. Best machining speeds are high with moderate feeds and cuts.

Tools should be gripped as near the cutting edge as possible. In addition machines must be free from vibration and lost motion in the feeding mechanisms if best results are to be obtained.

Chips are valuable and care to avoid contamination is desirable.

TURNING PRACTICE WITH ALUMINUM ALLOYS

		HIGH-CARBON OR HIGH-SPEED STEEL			CEMENTED-CARBIDE TOOLS		
	Alloy type	Max. cut, in.	Speed fpm.	Feed ipr.	Max. cut, in.	Speed fpm.	Feed ipr.
ROUGHING	Soft	0.250	700-1600	up to 0.050	0.250	4000-7000	up to 0.012
	Hard	0.200	up to 650	0.007-0.020	0.200	500-1300	up to 0.010
	High silicon	0.120	up to 400	0.007-0.020	0.120	500-1000	up to 0.008
FINISHING	Soft	0.040	1500-3500	0.004-0.015	0.020	6000-8000	up to 0.006
	Hard	0.020	600-2000	0.002-0.010	0.020	700-2500	up to 0.010
	High silicon	0.020	up to 600	0.002-0.004	0.020	500-1500	up to 0.004

MILLING PRACTICE WITH ALUMINUM ALLOYS

		HIGH-CARBON OR HIGH-SPEED STEEL				CEMENTED-CARBIDE TOOLS			
	Alloy type	Max. cut, in.	Speed, fpm.	Feed Max. fpm.	Feed in. per tooth	Max. cut, in.	Speed, fpm.	Feed Max. fpm.	Feed in. per tooth
Roughing	Soft	0.250	700-2000	10	0.005-0.025	0.300	3000-15,000	20	0.004-0.020
	Hard	0.200	500-1500	10	0.005-0.025	0.250	3000-15,000	20	0.004-0.020
Finishing	Soft	0.020	up to 5000	10	0.005-0.025	0.020	3000-15,000	20	0.004-0.020
	Hard	0.020	up to 4000	10	0.005-0.025	0.020	3000-15,000	20	0.004-0.020

When a premium can be secured for scrap of controlled composition, cuttings from different alloys are segregated.

Tool Materials

High-carbon steel is satisfactory at low cutting speeds or where few parts are to be produced. In addition, it is commonly used for fragile tools such as small drills and taps. In this class it often outperforms more expensive materials.

High-speed steel is used most widely. The 18-4-2 tungsten steels have a higher resistance to abrasion than the 18-4-1 steels and are better in most cases for aluminum alloys.

The molybdenum steels are as good as 18-4-1 in most applications. However the balanced 5.50 tungsten—5.50 molybdenum type is better than the molybdenum steels. Unless kept cool, they will burn during grinding. Cobalt steels have also been found suitable for aluminum.

Carbide tools are necessary for the alloys containing large amounts of silicon. They are also advantageous for large production runs on the other alloys.

Diamond-tipped tools are of value for light finishing cuts when an extremely fine finish or extremely accurate sizing is required.

Cutting Oils

Whenever heavy cuts and feeds are employed a coolant is desirable. For this purpose soda water or a lean, soluble-oil solution, perhaps with a little lard oil or kerosene added, is satisfactory. Such coolants are widely used for milling, drilling, and sawing.

When lubricating characteristics are required, a straight mineral oil with viscosity about 60 sec. Saybolt universal at 100 F. gives good results at little expense. Better results can be obtained by adding 5 to 10% of a fatty oil such as lard oil. Heavy cuts may require higher viscosity lubricants.

Many excellent proprietary oils designed especially for machining aluminum are available.

The cutting fluid should be supplied copiously, preferably under pressure, to the junction of tool and work. If applied from below, secondary clearance of the tool is increased to permit the cutting fluid to reach the cutting edge.

Turning and Boring

Lathe setups must be rigid because best results are obtained at relatively high speeds. Both tool and workholders should be of heavy construction. Soft liners between work and jaw faces prevent marring of the work.

Because thermal expansion is a major factor, internal expanding chucks should be checked often to see that the expansion does not loosen the grip. Expansion may put heavy end thrust on the tailstock so that live centers are preferable to fixed centers.

Long bars introduced through the lathe headstock should be supported on rollers to prevent whip by the free end.

Most authorities agree on round-nose tools with large rake angles set at or slightly above the center of the stock. If the rough and finish cuts are made with the same tool, the cutting edge should be restored before the finishing cut.

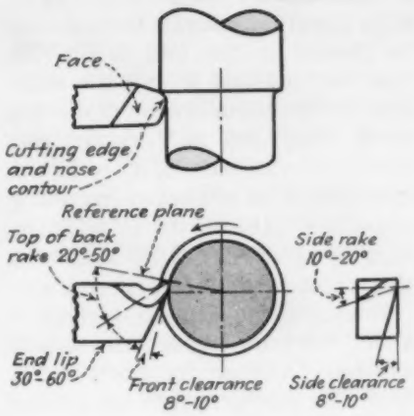
Tools may be made from conventional rectangular stock or toolbits for various special toolholders can be ground to the desired angles. Holders which support the toolbit in a near-vertical position are especially good because they allow large rake angles without weakening the bit.

Chip disposal may become a problem because of the continuous chips produced. Decreasing rake angles or increasing feed may cause more curl in the chips resulting in better chip breakage. These changes tend to reduce the quality of surface produced and the extent to which they can be employed varies with different alloys. When satisfactory chip control is not possible by these means, a chip breaker may be ground in the tool.

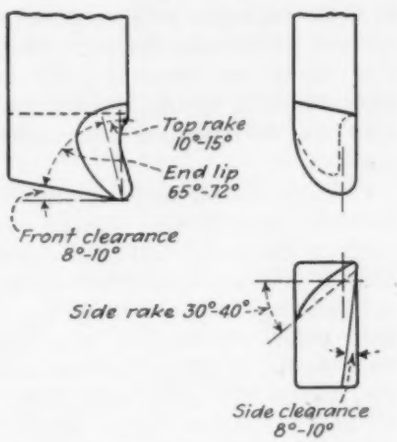
Boring tools generally have about the same angles as turning tools except that, naturally, front clearance must be larger for small bores so the tool will clear work.

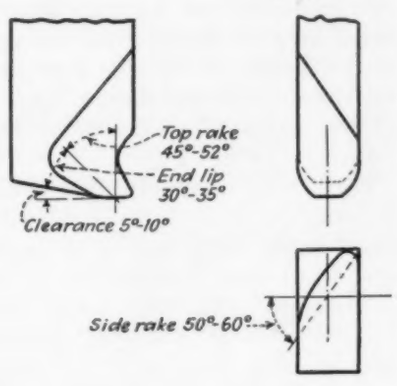
Screw-Machine Work

Box tools ground with a cutting angle of 82° having no top rake

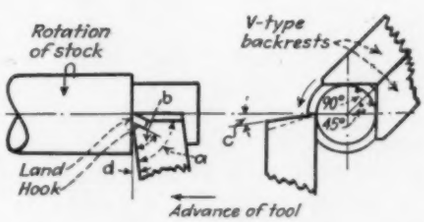


LATHE TOOL





PLANER TOOLS
Roughing (top) and Finishing



BOX TOOL for screw machines has clearance d of 8°, cutting angle a of 82°. Side rake c gives slicing action. V-hook is designed to produce cutting angle b 27 - 37°

are satisfactory for CP2 (11S-T3). With the other alloys a hook should be ground in the tool to provide freer cutting and to coil the chips and guide them away from the work. The hook is V-shaped and should provide rake of 45 to 55°. A land should be left between cutting edges and hook of 0.0 to 0.020 in. depending on depth of cut, with the larger lands for deeper cuts.

Round stock can be turned at about 700 fpm., hexagonal stock at 450 fpm., and square stock at 300 fpm. The slower speeds are needed because of the intermittent cutting action.

Cutoff tools with a front angle of 22 to 23° will give good results. On straight cutoff tools for heavy cuts this may be reduced to 8 to 15°. To avoid burrs in tubing, a cutoff tool may have two points on the cutting edge.

Circular cutoff tools should be provided with ½° side clearance in back of the point. Straight cutoff blades have 8 to 12° front clearance and normally some side clearance below the cutting edge but none on the length of the tool. For CP21 (11S-T3) a top rake of 0 to 3° and for other alloys of 5 to 10° is normal on circular cutoff tools. Straight cutoff tools are set in the toolholder to give 5 to 15° top rake. Sometimes a hook is necessary for cutoff of the softer alloys.

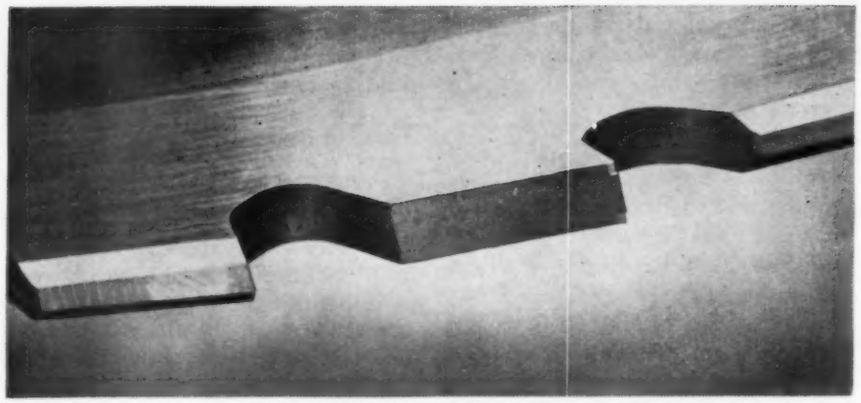
Drills with relatively slow spiral g("plastics" type) with wide, polished flutes and a 60° point angle are being used successfully.

Standard knurling tools are suitable. Large diameter knurls are desirable because of the high speeds. Best angle for knurl teeth is 90°.

Planing and Shaping

The relatively slow speeds generally available suggest that as heavy a roughing cut as possible should be made. Work must be anchored securely with rigid support. Roughing tools should be sturdy with moderate rake. Such a tool does most of the cutting at its side. Roughing cuts are generally taken at the maximum speed of the machine.

Finishing tools have large rake angles, are designed to take a slicing cut. Cuts should be light and feeds fine. The finishing tool must be lifted on the return stroke to avoid marring the work and rapid dulling of the tool. A shaping speed of about 400 fpm. is required for good finishes.



Chip-breaker saw is best for aluminum alloys. Alternate teeth cut wide, remaining teeth cut deep

Milling

Milling is probably the most efficient method of machining aluminum alloys. High cutting speeds are possible and relatively short chips are produced. Vertical milling is preferable when possible because of the greater ease of chip disposal.

Climb milling will result in more efficient cutting, less heating of tool and work, longer tool life and better finish. But climb milling should not be attempted except with rigid setups in sturdy machines free from play in table and feeding mechanism.

Cutter and spindle must be free from vibration, particularly with carbide-tipped cutters.

Milling cutters may be plain or inserted tooth. The inserted-tooth cutters are generally preferred when they are suitable. Relatively few teeth are employed and tooth design corresponds to the general principles of single-point tools. More teeth can be included for finishing cuts than for roughing cuts.

A spiral or helix on the teeth is desirable on plain cutters to give the slicing action desirable in cutting aluminum. Helical plain milling cutters may have helix angles of 50° if there is considerable top rake. If two helical cutters of opposite angles are mounted to balance axial thrust, the cutting edges should meet at an obtuse angle. This will avoid pockets in which chips might be packed.

Nicking the teeth of plain milling cutters will result in shorter chips and is sometimes necessary.

Drilling

For lathe and screw-machine work a straight 2-flute drill gives good results though a slow spiral is sometimes desirable.

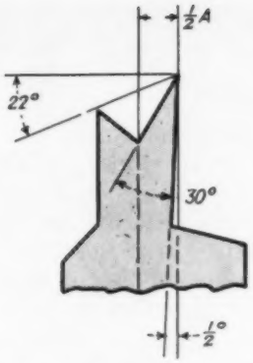
On drillpress work the standard 28° spiral drill is satisfactory especially on holes of medium depth. Deep or large holes are better done with drills of increased spiral. Large, deeply cut flutes with highly polished surfaces are desirable.

The standard point angle of 118° is satisfactory, but may be increased to 130 to 140° to facilitate chip removal and minimize burning. For high-silicon alloys the drill should have a sharper point for easier penetration. Drills for thin sheet, as with other materials, need to be very obtuse—almost flat—so the drill will cut the full diameter before the point breaks through.

Standard lip clearances of 12 to 15° may be increased to as much as 20° when feed is heavy or in drilling the softer alloys.

Small drills can generally be operated at the maximum speed of the drillpress. For larger drills, one recommendation is for speeds to give about 500 fpm. for carbon-steel drills, 600 fpm. for high-speed drills, and 2000 fpm. for carbide-tipped drills.

Power feeds may be increased with the diameter of the drill. For drills up to ⅜-in. dia. feeds may be 0.004 to 0.012 in. per revolution



Cutoff tool for tubing has two points to avoid forcing a burr into the hole

(ipr.); for drills ⅜- to 1¼-in. dia., 0.006 to 0.020 ipr.; and for drills over 1¼ in. dia., 0.016 to 0.035 ipr. Plain carbon drills should be fed at slower rates than high-speed or carbide drills; probably not over 0.020 ipr.

For anything but thin work, cutting oil in large quantity is desirable. It may be desirable to remove the drill several times so the oil will flood the hole completely. Drills of special design which supply coolant to the tip give excellent results.

Reaming

Best design for most applications is a reamer with 7 to 10° negative spiral (spiraled opposite to direction of rotation). Holes to be reamed should be 0.006- to 0.016-in. undersize so that a definite cut will be taken.

Reamers should have large, highly polished flutes. A reamer with alternating left and right spirals has less tendency to chatter and does not overfeed as will the straight positive spiral. Reamers should have radial rake of 5 to 10°, a narrow margin of 0.020 to 0.060 in. with relief of about 5 to 7° blending into a clearance of 15 to 20°. Carbide reamers should be about 20% thicker with as little clearance as possible.

Maximum peripheral speeds may be as high as 200 to 400 fpm. They should be considerably less on the harder alloys. Feeds for rough reaming may be 0.013 to 0.035 ipr., for finish reaming they should be about 0.003 to 0.010 ipr.

If variation in the size of reamed holes is encountered, the cause may be improper tool design or dull tools for preliminary operations which leave a work-hardened surface.

Tapping and Threading

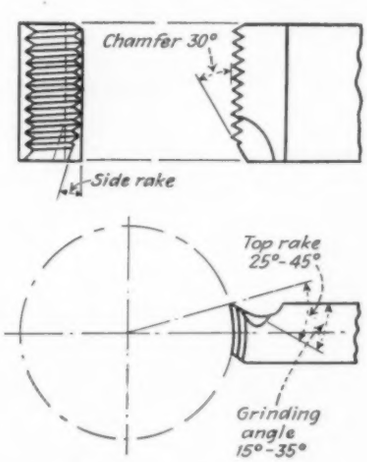
Aluminum threads have a tendency to seize. For this reason very fine threads and those with a sharp V-contour should be avoided. A rounded or trapezoidal thread that is smoothly cut is less likely to cause trouble. In addition, tight threads must be avoided. Tapping allowance can be less or an oversize tap can be used. Anti-seize compound or anodizing is desirable if threads are to be loosened and tightened frequently.

Taps should be undercut to provide top rake of 10 to 20°. Flutes should be deep, wide, and highly polished. Straight-fluted taps are satisfactory on the harder alloys; spiral-fluted taps are desirable on the softer alloys. For right-hand thread, the tap should have about 30 to 40° right-hand spiral.

For through holes (or blind holes with chip space at the bottom) spiral-pointed ("gun") taps cut freely and give excellent results. They cannot be used for tapered threads.

Threading dies should be undercut to provide top rake—about 25° for harder alloys, as much as 45° for the softer alloys. Backs of the lands should be slightly undercut to prevent clogging of the tool when backing off.

Thread chasing tools should have about 30° top rake. One recommendation is for a tool ground to the thread contour, with slight side rake, fed into the work at an angle of 30°.



Chasers for self-opening diehead

Sawing

Saws should have relatively coarse teeth with curved gullets, and should be free from sharp corners, burred edges, or rough surfaces to which cuttings could adhere. A small clearance must be provided so that sides of the teeth will not drag.

Circular saws with broad teeth are widely used, but saws with chip-breaker teeth are more satisfactory. Alternate teeth of these saws cut wide and deep. Teeth with alternate side rake are also good. Rake should be about 15°. In the larger sizes inserted teeth of high-speed steel or carbide are available. Top rake or "hook" may be as high as 45° for the soft, gummy alloys, but would be much less for the harder alloys. Carbide teeth have top rake of 5 to 10°.

High speeds with light feeds are desirable. With carbide teeth, speeds range up to 15,000 fpm. High-speed saws are run at about 5000 to 7000 fpm. Feeds range from about 2 ipm. for the hardest alloys to about 24 ipm. for the softest.

Bandsawing machines perform well on aluminum alloys. Blades of spring-tempered steel are suitable for light work and may be sharpened by filing. For heavier work the flexible-back saw with teeth hardened to the gullet is preferable. Friction sawing is not recommended. Alternate set teeth are good with side rake of about 15° and top rake of 10 to 20°. With hand feeding, less top rake is needed to avoid overfeeding. Blades must be supported both above and below the work. Blade speeds normally range from about 2000 to 5000 fpm. but may be as high as 7500 fpm. for thin stock. Blades should have as few teeth as possible for the work thickness.

Hacksaw blades with wavy-set teeth, about 5 to 15 per in., work well for hand cutting.

Lubrication is essential for all but the lightest cuts. Soluble oils or mineral-base oils are good. In some cases paraffin or heavy grease can be applied to the blade.

Rubber-bonded abrasive cutoff wheels are useful for cutting the

harder alloys, especially those of high-silicon content. Abrasive wheels will load on the softer alloys, and sawing is preferred.

Filing

The softer aluminum alloys tend to clog the teeth of the file unless little pressure is applied. For filing roughness from castings, a special file which has coarse upcut teeth with a fine overcut tooth is desirable. This design results in many small scallops which break up the filings and allow the file to clear itself of chips. This file leaves a better finish.

For sheet and bar aluminum, a coarse single-cut file with curved teeth, or a milled-tooth file, is recommended.

For finer finish a finer single-cut file such as the mill bastard or long-angle lathe file is advisable. The long-angle lathe file, which has 45 to 55° side shear which helps force filings from the teeth, is especially good for finish filing of small to medium work.

On intricate operations where shaped files are needed, regular American or Swiss pattern files with light pressure will serve.

Rotary files or burs should have coarse, sharp, spiralled teeth with smooth, deep flutes. The notched type is less likely to clog. They are operated at high speeds.

Grinding

Hard, free-machining alloys can be ground with good results but there is considerable difficulty with the common alloys, especially in the softer tempers.

Silicon-carbide wheels of the free-cutting types are generally best. Aluminous abrasives are sometimes employed for rough grinding.

For rough grinding, a silicon-carbide wheel of medium hardness and about 24 to 30 grit in a synthetic resin bond is satisfactory. For finish grinding, softer silicon wheels of 30 to 40 grit in a vitrified bond are common.

Speeds up to 9000 fpm. are possible for rough grinding, with not over about 6000 fpm. for finish grinding. Normal table traverse speeds serve for rough grinding, but are reduced considerably for finish grinding.

A soluble oil at about 30 or 40 to 1 is a suitable grinding compound. Grindings must be removed from the compound before it is recirculated.

3 SHEET-WORKING METHODS

Most of the aluminum alloys can be readily formed cold. However the wide range of properties and of the alloys and tempers of a given alloy make for considerable variation in the amount of forming or drawing possible.

The nonheat-treatable alloys, A2 (2S), MI (3S), 4S and GR1 (52S) work harden but have good forming qualities in the softer tempers. Less severe operations are possible when starting with the harder tempers. GR1 (52S) strain hardens rapidly and is not suitable for deep drawing.

The heat-treatable alloys, CS41 (14S and R301), CM21 (17S), CG21 (24S), GS21 (61S and R361), and ZG42 (75S) can be formed readily in the annealed temper and are often worked in this state. GS21 can be worked much like soft M1 (3S). The others have only fair forming qualities, even in the soft temper. Some work can be done after solution heat-treatment and quenching but the work must be done as quickly as possible after the quench.

Serious distortion develops during quenching and whenever possible these alloys should be heat-treated before forming.

Shearing and Blanking

All alloys, regardless of temper, can be sheared in conventional equipment of suitable capacity. If shears have a mechanical hold-down, clearance should be about 0.1 the sheet thickness. A low rake angle on the upper knife is desirable for thin stock to reduce twist. A problem is marking of finished sheets by the hold-downs. Covering the table with Kraft wrapping paper or fiber board and equipping the hold-down feet with composition pads or rubber cups will prevent marking.

Clearance for blanking tools is about 10% of sheet thickness and for punching is about 5%. Dies should taper about 0.75° away from the cutting edge. Punches are generally annealed tool steel and dies are hardened tool steel. Cutting edges of both punch and die must be kept sharp.

To reduce the press load in

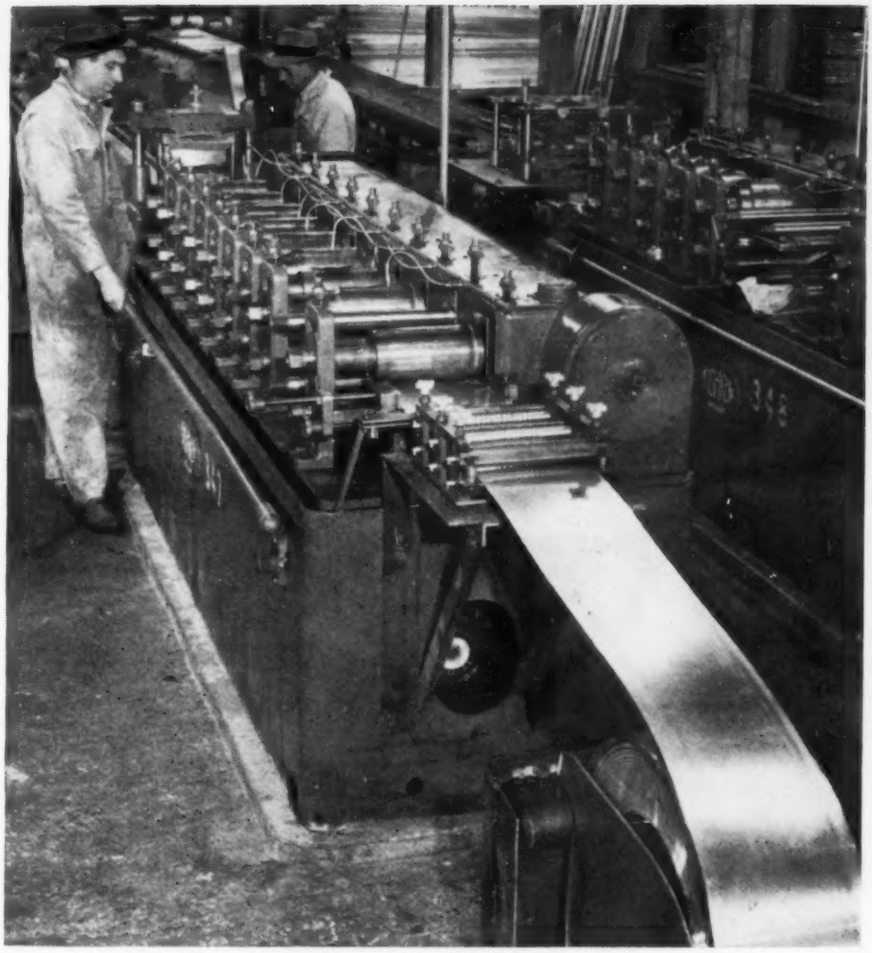
Reduction in Deep Draws

Operation	Reduction
Blank (D)	
First draw (D_1)	0.40D
Second draw (D_2)	$0.20D_1$
Third draw (D_3)	$0.15D_2$
Fourth draw (D_4)	$0.15D_3$

TYPICAL RADII FOR 90° BEND

(In terms of thickness, t)

Alloy	APPROXIMATE THICKNESS 1/64	1/32	1/16	1/8	3/16	1/4
2S-O	0	0	0	0	0	0
14S-O	0	0	0	0	0-1t	0-1t
52S-H32	0	0	0-1t	½t-1½t	1t-2t	1½t-3t
61S-T4	0-1t	0-1t	½t-1½t	1t-2t	1½t-3t	2t-4t
2S-H18	0-1t	½t-1½t	1t-2t	1½t-3t	2t-4t	2t-4t
52S-H38	½t-1½t	1t-2t	1½t-3t	2t-4t	3t-5t	4t-6t
24S-T4	1½t-3t	2t-4t	3t-5t	4t-6t	4t-6t	5t-7t
14S-T6 75S-T6	2t-4t	3t-5t	4t-6t	5t-7t	5t-7t	6t-10t



Roll forming machine produces continuous shaped work from coiled strip

blanking, the die can be ground at a tilt, preferably on two planes to provide two high and two low points. These should vary from flat by an amount equal to 50 to 100% of sheet thickness, preferably the latter. Punches should be ground flat. For piercing operations the die must be flat but the punch can be ground at an angle.

Band saws and routers are suitable for blank production.

Bending

Bending is possible in brakes or with rolls by conventional methods. Equipment must be kept clean to avoid marring the surface. The radius required may vary from 0 to 10 times sheet thickness, depending on alloy, temper, and thickness.

Forming

The Guerin process is widely used for forming and shallow drawing. A rubber pad serves as the die and, being confined in a steel pan, bends the work to the shape of the punch. It has the advantage, in addition to tooling economy, that spring-back can be compensated for by tapering the sides of the punch so that the work is overbent.

Power hammers are also employed for forming and shallow drawing. The sheet can be shaped to the dies by a single blow or by a series of blows.

Aluminum sheet is also formed in stretcher presses. This method is suitable for sweeping contours and causes little trouble from spring-back.

When forming thin sheet in a press brake the female die is sometimes lined with neoprene or the sheet is covered with Scotch tape to prevent marking.

Drawing

Equipment and tools are similar to those for drawing other metals. If successive draws are made without annealing, the amount of reduction per draw must be reduced progressively in the first steps. There is little change in hardness after the third draw.

Radius on the die should be 4 to 15 times the metal thickness. Punch radius should be at least four times metal thickness.

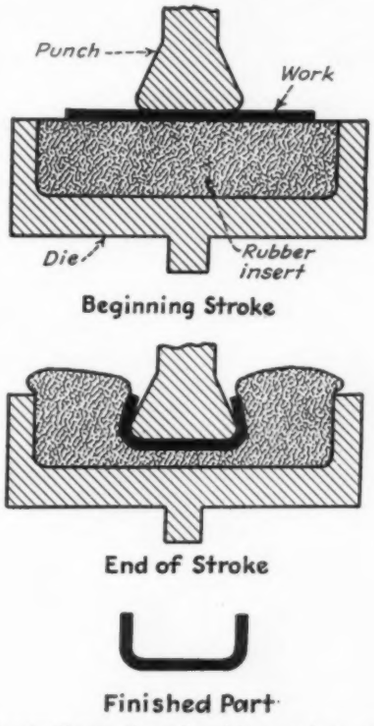
Dies and punches should be designed so that there is little change in metal thickness. This design factor is quite different from practice on steel and brass and tools designed for the latter are not likely to work with aluminum.

Mineral oils are generally required for lubrication. Soluble oils are not generally suitable. For severe draws a mixture of mutton tallow and paraffin is suitable.

Spinning

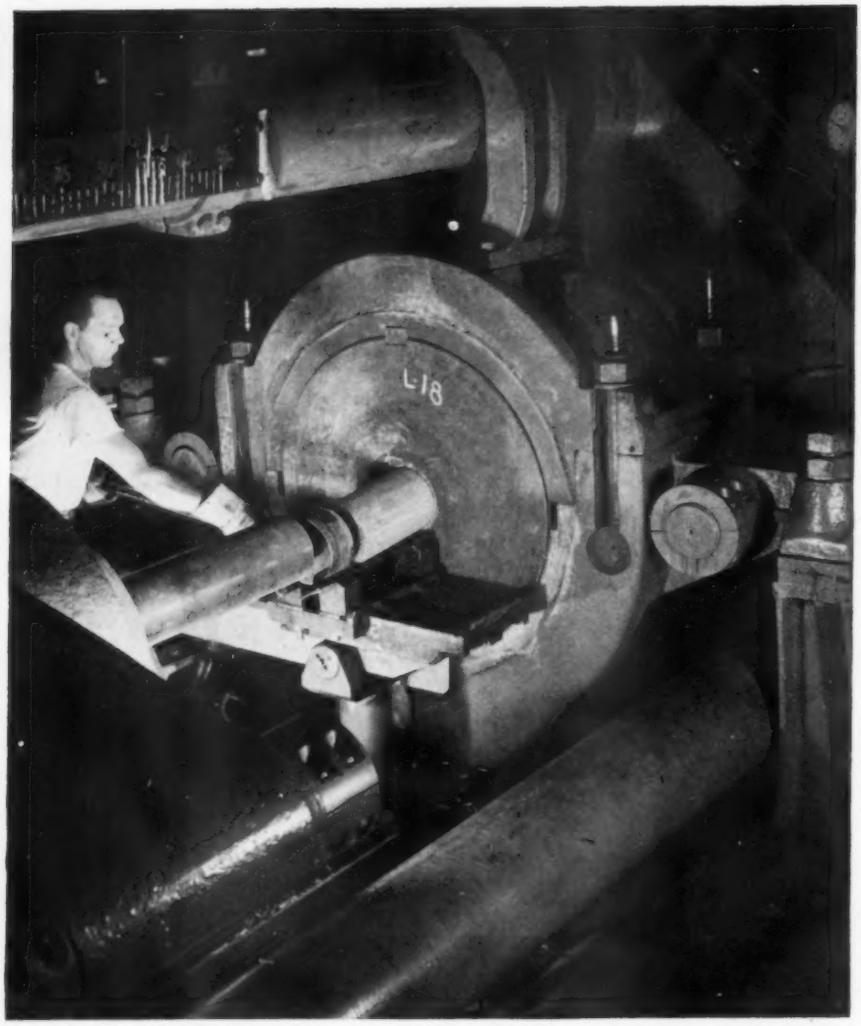
Spinning, alone or in combination with drawing, is an economical method of producing parts. Pure aluminum A2 (2S) can be spun cold to complicated shapes. M1 (3S) is widely used because of its higher yield strength, but is not quite as easy to form. If GR1 (52S) or the heat-treatable alloys are spun, they must be annealed frequently or heated with a torch before spinning.

Beeswax, tallow, and petroleum jelly are suitable lubricants for most work. Large blanks can be lubricated with laundry soap.



Tapered punch and rubber pad compensate for spring-back

4 CASTING AND FORGING



Regular extrusions are made in special press by forcing heated ingot through a suitable die. Here the ingot is being loaded. Extrusion is one of the most economical forms in which to use aluminum alloys. A number of firms produce extrusions in standard and special shapes

There are about a hundred casting alloys commercially available today. However, about ten of these account for most of the production and will meet nearly all requirements. Commercially pure aluminum is not suitable for casting.

It is desirable to have uniform sections throughout a casting. Variations in section may cause shrinkage and cracking. If changes are necessary, they should be gradual. Minimum section thickness for sand castings is generally 3/16 in.

If ribs are involved, it is desirable to have them project into the bottom part of the mold.

Generous fillets are desirable. Shrinkage may vary from 1/10 to 5/32 in. per ft. Allowance for machining will generally vary from 1/8 in. in small and medium casting to ¼ in. or more in large castings.

Inserts can be cast in place. Cast iron and steel are most common, though copper and brass inserts are practical with proper care. No metallurgical bonding will take place so inserts must be designed for mechanical retention.

Sand Casting

Cores may be made of either green or dry sand. Foundry practice in general follows the methods employed with other metals. It is important to deliver the metal to the mold with as little oxide content as possible. The light weight lowers mold pressures and permits lighter ramming.

Some of the alloys, especially those containing copper, are hot short. They pass through a range of low strength just after solidification. Care is necessary to avoid cracking while in this range.

Gates and risers are removed with bandsaws when possible. Circular saws, hacksaws and pneumatic chipping hammers are also employed. Flexible-shaft grinders are ideal for snagging. Surface speeds of 5000 to 7000 or even 10,000 fpm. with aluminous abrasive wheels from No. 14 to No. 36 are customary. Polishing is accomplished with canvas or muslin wheels or hand or rotary files. Sand-, dust-, steelgrit-, or shot-blasting are excellent cleaning methods.

Permanent-Mold Casting

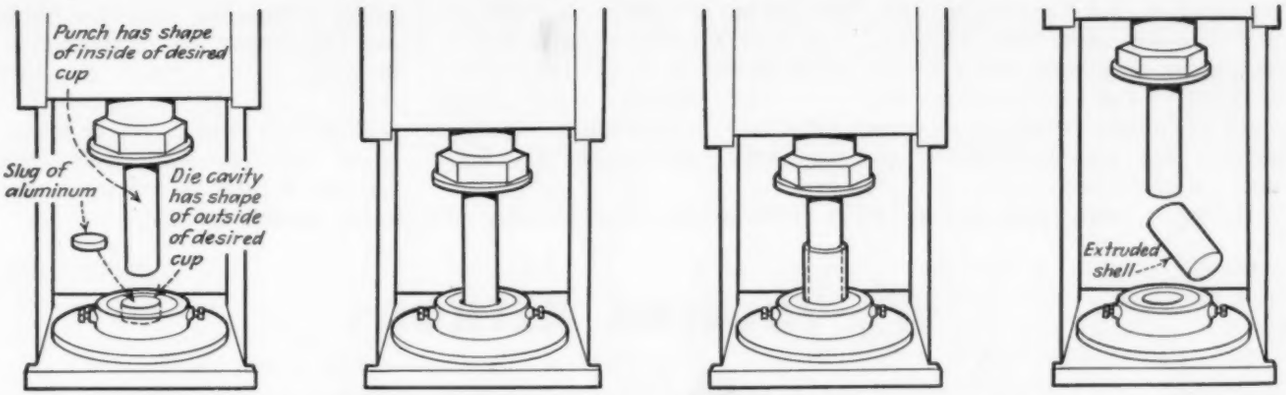
Castings in permanent molds with either sand or permanent cores can give closer size control, finer grain structure, and higher tensile strength than sand casting.

When possible, heavier sections should be located at the parting line. Cooling of thick sections can be speeded with an air blast or ribs on the outside of the mold. Cooling of thin sections can be retarded by covering this section of the mold with asbestos.

Molds are usually made of gray cast iron. The cavity should be highly polished and then several thin coats of a suitable mold coating applied. Available coatings contain one or more refractory materials such as French chalk, china clay, whiting, talc, asbestos, mica, and fireclay. The coating is sprayed into the mold at about 400 F., then polished with fine steel wool.

Investment Casting

Precision investment castings are made with plaster molds generally produced from master patterns



Impact extrusion forms cup-shaped parts like this, usually in high-speed crank presses. It is possible to extrude the metal through an orifice in the lower die to produce work with a stem. Most impact extrusions are made with A2 (2S) but shells with heavy walls can be extruded from A51S and GS21 (61S)

rather than by the more expensive lost-wax process. If the mold is chilled to —50 F. and cooling liquid (in larger castings) is piped through the mold, aluminum alloys can be cast with tensile strength about twice that obtained by other methods. The process has been described in detail in an AMERICAN MACHINIST Special Report.

Die Casting

Aluminum die castings have replaced zinc in many applications. The alloys most often used are SC7 (A380), which is the cheapest; SG3 (360 and A360), which has high corrosion resistance, easy casting and molding qualities, but less impact strength; and 218, which gives the best properties but requires more care and closer control in casting.

Forging

Of the nonheat-treatable alloys, A2 (2S), M1 (3S), and GR1 (52S) are forged to some extent, though higher strength than they afford is a usual requirement when forging is considered.

Forgings are made from stock in as fabricated condition, then heat-treated to desired temper: CS 41 (14S-T6) (where highest strength is required) or 14S-T4 (used for work formerly forged from CM21 (17S). Aircraft propellers, and jet impellers are forged of 25S-T6. Pistons for internal-combustion engines are forged of 18S-T61 and 32S-T6.

Excellent forging characteristics are found in A51S. Because of their high yield strength there has been some work done with ZG42 (75S) and R303, but they are harder to forge than the other alloys.

In a temperature range just below the melting point, aluminum alloys become brittle or hot short. Some of the alloys are also cold short. This establishes a relatively limited temperature range within which forging must be completed.

Where it is possible, some designers sink the entire impression in one die. When this is not possible, the parting line is located as it would be for steel.

Dies require more liberal corner and fillet radii than is necessary for steel. Even relatively wide ribs should have full radii, rather than a flat section in the center.

It is possible to form holes in parts by forging a depression that leaves a 1/8-in. web, but the depth of the depression should not exceed 2/3 the width or diameter. When the web is punched out it is not advisable to attempt to punch out part of the draft and fillet sections as could be done with steel.

For hammer forging the standard draft angle is 7°. There is no established standard for press forgings, with practice varying from 0 to 7°. The most common angle is probably 1 to 3°.

All of the aluminum alloys can be hammer forged. However, ZG42 (75S) can be hammer forged with considerable difficulty and users report better results with press forging. All of the alloys can be forged in either mechanical or hydraulic presses.

Cold press forging is possible when little horizontal metal flow is required. For extensive cold forging, it may be necessary to divide the operation into several stages and anneal after each stage.

Dies for press forging are ordinarily hardened to 55 to 60 scleroscope or higher. Hammer dies may be this hard for wide, thin forgings, but for average work should be from 48 to 51 and large dies with deep impressions are preferably 43 to 48 scleroscope.

A smoother surface is required than is necessary for forging steel. Polishing marks should be in the direction of metal flow.

Dies are preheated to 250 to 400 F. before operating and with hammer dies the first 50 to 100 blows should be taken lightly.

Lubricant, sprayed or swabbed

TYPICAL FORGING TEMPERATURES

Alloy Number		Blocking, °F.		Finishing, °F.	
ASTM	Alcoa	Minimum	Maximum	Minimum	Maximum
CM21	17S	780	810	800	830
CS41	14S	650	830	650	830
———	25S	—	860	—	860
———	A51S	—	870	—	870
GS21	61S	—	880	—	880
ZG42	75S	675	730	700	750

on the dies, is a mixture of high- and low-viscosity oils. Mineral, vegetable, or animal-base oils can be used as the high-viscosity oil, This is mixed with a suitable solvent for easier spreading in about a 50-50 proportion.

Rolled or extruded stock can be forged but the grain structures are different. Rolled stock is preferable, especially in the larger sizes. Aluminum forgings show greater difference in properties with and across the grain than do steel forgings.

With proper heat-treating and aging, properties that are quite satisfactory can be obtained from forgings made from extruded stock.

After bar stock is cut to length, edges are frequently chamfered. Surface defects in the stock may cause serious difficulty.

5 JOINING METHODS

Riveting

Rivet holes may be drilled, punched, subdrilled and reamed, or subpunched and reamed. Reamed holes are much preferred. It is easier to drive rivets when clearance is small—about 2 to 3% of the shank diameter is ideal. Hot rivets require slightly more clearance. Clean, sharp tools are required and burrs and chips should be removed.

When countersinking for flush riveting, a stop to prevent going too deep is desired. Sheet up to about 1/16-in. thickness is dimpled rather than countersunk. A dimpled joint is stronger than a countersunk joint.

Faying surfaces should always be painted before assembly for maximum resistance to corrosion. The metal is cleaned with a phosphoric-acid solvent compound followed by a single coat of zinc-chromate primer. This should dry before assembly. Work must be assembled *firmly* with bolts before riveting is begun.

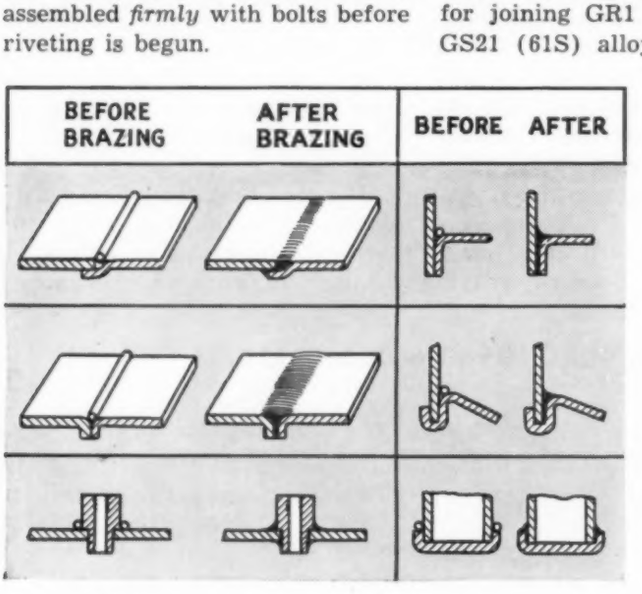
Rivets of pure aluminum (2S-0) are used only for non-structural joints and are easily driven cold. Rivets made of A17S-T4 are driven cold and are suitable for joining CS41 (14S), CM21 (17S), and CG21 (24S). Rivets of CM21 (17S-T4) are reheated just prior to use after which they are driven before age hardening (which starts in 1 to 2 hr.). In the larger sizes they can be driven hot. They are used for the same alloys as A17S-T4 and are somewhat stronger if driven properly. Rivets of CG21 (24S-T4) are also reheat-treated just before driving but remain soft after quenching only about 20 min. These rivets are the strongest and hardest to drive. Both CM21 (17S-T4) and CG21 (24S-T4) can be kept soft longer by storing at low temperatures, generally with dry ice for cooling. Rivets of 53S-T61 are driven cold without reheat-treatment. They have excellent corrosion resistance for joining GR1 (52S), 53S, and GS21 (61S) alloys.

Blind rivets are available in the smaller sizes which can be driven from one side only. These are of various special designs.

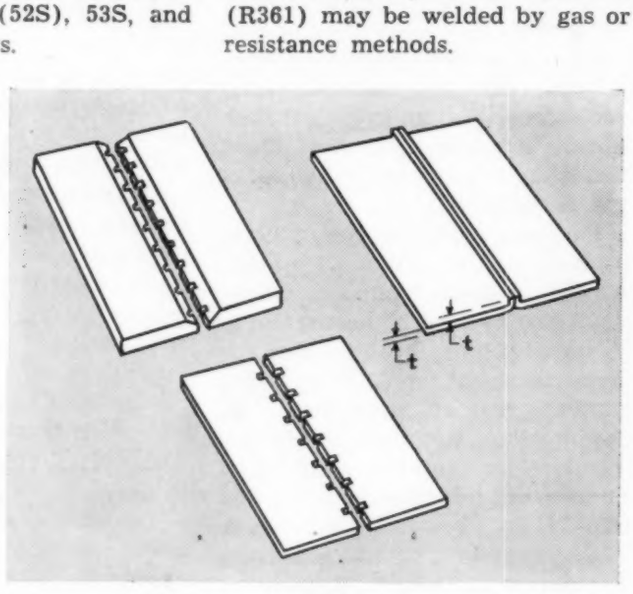
Minimum spacing is three times rivet diameter; in general, the maximum is 24 times the thickness of the work. Edge distance usually should be at least twice rivet dia.

Weldability

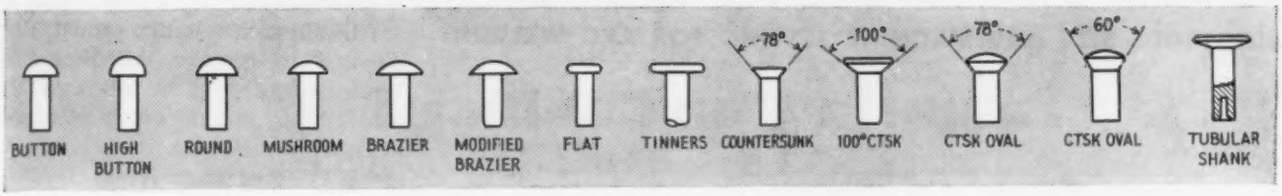
Easiest welding alloy is A2 (2S) (commercially pure aluminum), but many of the alloys are suitable for economical welds. The M1 (3S) alloy is almost as good as A2 and has higher mechanical properties. For higher strength GR1 (52S) is suitable, especially for resistance welding. 53S and GS21 (61S) are widely used where structural strength is important and work can be heat-treated after welding. Alloys containing copper, such as clad CG21 (24S) and CS41 (14S and R301) are suited to resistance welding. R353 and GS21 (R361) may be welded by gas or resistance methods.



Brazed joints are made in such forms as these, rather than attempt butt or fillet connections



Work prepared for gas welding (left to right); beveled and notched, notched, flange joint



Head shapes of aluminum rivets. In addition, there are various designs of blind rivets

Gas Welding

Equally good results are obtained with oxyhydrogen or oxy-acetylene flames. The flame is adjusted with a larger tip for hydrogen than for acetylene. A neutral or slightly reducing flame gives best results with speed and economy.

Jigs and fixtures must be designed to permit expansion and contraction of the work without stressing the joints. Sometimes it is satisfactory to have clamps no closer than 6 in. to the weld. In other cases it may be satisfactory to tack weld the joint, then loosen the clamp slightly.

Welding rods of A2 (2S) are customary for welding A2 (2S) and MI (3S). For GR1 (52S), and GS21 (61S and R361), a 5% silicon rod is suitable. Intricate castings or sheet more than ⅜ in. thick should be preheated to about 800 F. Preheating should not exceed this temperature or the work might collapse.

Edges may be bent up in this work to a distance equal to sheet thickness. This metal serves as filler and no welding rod is needed. Unbeveled butt welds are made in work of thicknesses up to about 3/16 in. Except in thin sheet, the edge is notched with a chisel or saw at about 3/16 in. intervals. Notching facilitates weld penetration, prevents local distortion, and minimizes burning.

Surfaces should be clean of grease, oil, dirt. When the surface is heavily oxidized, etching may be required. Generally wire brushing is sufficient. Welding flux is available for aluminum welding and must be used to break down the oxide coating. It is usually in powder form and is mixed with water to form a thin paste which can be applied to the edges before preheating. Flux must be liberally applied.

Flux must be removed after welding. Sometimes a brush and boiling water or a steam jet are satisfactory. Inaccessible areas can be cleaned up by: (1) 30 min. in cold 10% sulfuric acid, (2) 5 to 10 min. in 5% sulfuric acid at 150 F., or (3) 10 to 20 min. in cold 10 to 50% nitric acid. In any case rinse in cold, then hot, water.

Welds in A2 (2S) and M1 (3S) can be chipped off almost flush, then hammered smooth when such a finish is desired. Other welds can be finished by grinding or filing.

Arc Welding

Most arc welding is done with coated electrodes of A2 (2S) or the 5% silicon alloy. Sheet less than ⅛ in. thick is not usually arc welded. Plate over ¼ in. is generally beveled to within 1/4 in. of the bottom.

Operators accustomed to welding steel will require some practice. The arc is struck by a motion similar to striking a match. Touching the rod to the work will usually result in freezing of the rod to the work.

Movement is in a straight line along the weld with the rod held at right angles to the surface or tilted *slightly* forward. The arc should be kept as short as possible. A length of 1/8 to 3/16 in. is best.

Conventional equipment is used with reverse polarity (electrode positive). When multipass welds are made flux must be removed with a wire brush between passes. After the weld is completed it should be wire brushed, then cleaned in the same way as a gas weld.

Carbon-arc welding produces welds of equal soundness with considerably less distortion. It may be either manual or automatic. Electrode is negative but settings are similar to metal-arc welding. Filler rod is fed in a manner similar to gas welding.

Shielded-arc welding, developed for magnesium, is being used increasingly for aluminum alloys. It employs a tungsten electrode, a filler rod, and an inert shield of argon or helium gas. The metal must be cleaned carefully, preferably with an abrasive or a caustic-etch followed by a sulfuric acid dip and rinse. No flux is required, which eliminates the need for cleaning after welding. The method is especially good for GR1 (52S).

Atomic hydrogen welding (arc between two tungsten electrodes in an atmosphere of hydrogen) gives high welding speeds with good results. Procedure is similar to gas welding.

TIP SIZES AND PRESSURES FOR GAS WELDING

Sheet Thickness B. & S. Gage	OXYHYDROGEN			OXYACETYLENE		
	Diameter of tip in.	Oxygen psi.	Hydrogen psi.	Diameter of tip in.	Oxygen psi.	Acetylene psi.
24-22	0.035	1	1	0.025	1	1
20-18	0.045	1	1	0.035	1	1
16-14	0.065	2	1	0.045	2	2
12-10	0.075	2	1	0.055	3	3
1/8-3/16	0.095	3	2	0.065	4	4
¼	0.105	4	2	0.075	5	5
5/16	0.115	4	2	0.085	5	5
⅜	0.125	5	3	0.095	6	6
⅝	0.150	8	6	0.105	7	7

ELECTRODE SIZE AND MACHINE SETTING FOR ARC WELDING

Metal thickness, in.	Electrode dia. in.	Approximate current amp.	Number of passes	
			Butt	Lap and Fillet
0.081	1/8	60	1	1
0.101	1/8	70	1	1
0.125	1/8	80	1	1
0.156	1/8	100	1	1
0.187	5/32	125	1	1
0-250	3/16	160	1	1
0.375	3/16 for lap and fillet 1/4 for butt	200	2	3
0.500	3/16 for lap and fillet	300	3	3
0.500	1/4 for butt			

Resistance Welding

Spot welding is possible with ac. (single phase or three phase), magnetic energy-storage, or condenser or battery energy-storage equipment. The ac. equipment is widely used and is cheaper. The stored-energy equipment gives better surface finish.

High currents and short times are required. Dome tips are customary but one tip can be flat when necessary. The flat tip should be used on the thicker member.

A solvent cleaning is adequate for A2 (2S) and M1 (3S). Other alloys require etching or mechanical cleaning to remove the oxide coating (See *Cleaning*, next page).

Parts should be designed so that electrodes will be at right angles to the surface and welds must not be further from the edge than the throat depth of available equipment. If spacing is less than eight times the work thickness, higher currents must be used on all welds after the first.

Seam welds with roll-type electrodes produce continuous or intermittent seams. Water cooling is necessary.

Flash welding to produce butt or miter welds is an excellent production method. It is generally employed with A2 (2S), M1 (3S), GS21 (61S and R361). Welds are of lower strength than the parent metal but it is possible to join dissimilar alloys or aluminum alloys to metals such as copper or steel. Special machines and dies are required, making high production necessary to justify the equipment. Rates as high as 200 welds per hour are obtained in some cases.

Brazing

Brazing by torch, dip, or furnace methods is possible with A2 (2S), M1 (3S), GS21 (61S and R361). Parts are generally not joined with butt or scarf joints. Lock seam, tie, line contact, or lap joints are satisfactory. Clearance between parts is necessary for the flow of filler. Filler is available in forms such as wire, washers, and clips.

Brazing sheet is available. This can be obtained with a core of 3S or of a heat-treatable alloy and a coating on one or both sides of filler material. When parts are shaped from brazing sheet by bending, drawing, or hammering, they can be brazed without requiring additional filler.

For furnace brazing the filler material is placed at the joint. Flux mixed with water is brushed or sprayed on the metal and the work is placed in a furnace. Accurate temperature control is essential. Temperature is between 1000 and 1200 F. and will depend on the alloy being brazed. Time will depend on thickness but is 2 to 6 min. after the work reaches brazing temperature.

Torch brazing is similar with a flux applied to the joint, the area heated locally with a welding torch, and filler applied with a brazing rod. The speed is greater than with gas welding.

In dip brazing, parts are assembled with filler, then dipped in molten flux. Commercial experience with this method is limited. Parts are generally preheated to 900 to 1000 F. Depending on shape and thickness, the dip lasts ½ to 3 min.

All brazed joints must be cleaned to remove the flux. A boiling-water dip is followed by 5 to 15 min. in concentrated nitric acid or 5 to 10 min. in 10% nitric —0.25% hydrofluoric acid, followered by a hot-water rinse to remove the acid.

Another method is a boiling-water dip, 45 to 60 sec. in 5% sodium hydroxide at 150 F., rinse, 1 to 2 min. in cold 50% nitric acid, and a final rinse.

Thin work must have less drastic treatment. Hot water followed by 5 to 10 min. in 10% nitric acid—10% sodium dichromate, and a final hot-water rinse is suitable.

Soldering

Soldering is readily possible but does not produce a particularly satisfactory joint. It is not suitable at all when the joint will be exposed to corrosive atmospheres, and a painted or varnish coating is nearly always desirable.

Oxide is removed by wire brushing or with a flux. An ordinary soldering iron will work if the tip is tinned with lead-tin solder. An aluminum solder is then used for joining.

When surfaces are accessible the solder is melted on the surface and abraded with a soldering iron, scraper, steel wool, or wire brush. After the surfaces are alloyed with the solder, they are placed together and heated. Additional solder may be required.

Recently developed aluminum solders are a considerable improvement over earlier efforts. Among the solders which are reported to have given good results are Alumaweld Special, Eutecrod 199, and Prolyt II.

Resin Bonding

All of the aluminum alloys can be joined by adhesives and this method is especially suitable where large lap joints are required. Solvent cleaning is often adequate, though various special cleaning solutions may be needed for the heat-treatable alloys. Heat and pressure are required in nearly all cases. Thermoplastic, thermosetting, and vulcanizable bonds can be produced.

6 CLEANING AND FINISHING

Aluminum has a pleasing natural color that dulls only slightly with use. Its resistance to corrosion is great enough that for many applications no additional protection is needed. Some of the alloys have markedly poorer corrosion resistance than the pure aluminum.

Many finishes can be applied either for additional protection or for decoration. Among the most important is the group of anodic or electrolytic-oxide coatings.

Cleaning

Suitable cleaning is a necessary prerequisite to any finishing method and will often be desirable when no finish is to be applied. Oil and wax films are the most likely to cause trouble. Cleaning methods include hand washing, solvent cleaning, acid cleaning, alkaline cleaning, emulsion cleaning, and vapor degreasing. As with most other metals, special cleaning steps are required before resistance welding or electroplating of the alloys.

Various commercial cleaning compounds are available. One formula for acid cleaning is a water solution containing 10% of 85% phosphoric acid, 40% of butyl alcohol, 30% of isopropyl alcohol, and a small amount of a wetting agent. It will remove light oxide films and leaves a thin aluminum phosphate film that will promote paint adhesion.

For alkaline cleaning (which is more common than acid cleaning) an inhibited mild solution at 160 to 180 F. will remove light grease and oil films, dirt, chips, and other foreign material, in 3 to 5 min. Many of the cleaners now available consist of tetrasodium pyrophosphate with an inhibitor such as sodium metasilicate. Others are sodium carbonate or trisodium phosphate inhibited with sodium disilicate.

Sometimes aluminum is cleaned by coating work with a petroleum solvent which has a boiling point of about 350 F. and passing it through a tunnel oven at about 425 F. The work is usually held at this temperature at least 5 min. The solvent spreads the grease and oil into a thin film which oxidizes in the oven. This cleaning method may soften the temper of aluminum sheet.

Mechanical Finishing

Smooth, lustrous finishes are obtained on aluminum alloys by mechanical finishing by the methods outlined in the table. Other effective methods are sandblasting, scratchbrushing, satin finishing, and peening.

Chemical Finishing

Frosted finish is a decorative silvery-white finish. It is not permanent and is easily marked with fingerprints. The finish is generally followed with an anodic treatment or the work is coated with a clear lacquer. Frosted finish is applied by etching in a hot caustic-soda solution and is carried out under a wide range of conditions, depending on the alloy and the finish required.

A frequent method is 1-min. immersion in 15% sodium hydroxide at 160 to 180 F. Concentrations can vary from 2 to 25%. Boiling temperature is faster but may cause stains. This can sometimes be avoided by immersion in a 2% solution following the first dip. After a cold-water rinse the work is neutralized by a dip in cold 50% nitric acid. After a final cold-water rinse, the parts are dried on a steam table or by compressed air. High-silicon alloys require about 1% hydrofluoric acid in the nitric-acid dip.

Designs may be etched by printing the areas not to be etched with lithographic ink and, while damp, dusting with asphaltum powder. This is fused at about 400 F. Exposed areas are then activated in 10% hydrofluoric acid and rinsed.

MECHANICAL FINISHING OF ALUMINUM ALLOYS

	ROUGHING			GREASING OR OILING	BUFFING	COLORING	FINISH GRINDING[1]
	Solid Wheel	Cloth Belt	Sewed Muslin				
Abrasive	Al_2O_3 or SiC	Al_2O_3	Al_2O_3	Turkish emery	Tripoli	Fine lime or soft silica	SiC
Carrier	Solid wheel	Cloth belt	Sewed muslin buffs	Sewed muslin buffs	Pocketed muslin buffs	Open muslin or flannel	Solid wheel
Grit	16 to 100	46 to 300	46 to 80	120 to 240			30 to 40
Bond	Phenolic resin	Glue	Glue	Glue			Vitrified
Hardness	Medium		Medium	Medium	Soft	Very Soft	Soft
Peripheral speed of wheel, fpm.	6000 to 12,000	3000	6000	6000	7000 to 8000	3000 to 4000	6000 to 7000
Lubricant	Dry or grease	Grease or kerosene	Grease	Grease	Grease		Soluble oil 1 to 35 or 40

[1]Mechanical finish applied to castings—to be preceded by machining.

The most commonly found etching bath contains iron and copper chlorides and hydrochloric acid. When etching has reached the desired depth, the work is removed and rinsed. The etched area may be left plain or colored with various finishes. Finally the "resist" is removed from the unetched areas with an organic solvent.

Oxide coatings may be produced chemically by a group of treatments known as Alrok. They are cheaper and easier to apply than anodic oxide coatings but are not as durable or attractive. They make an excellent paint base.

Electrolytic Finishing

The electrolytic-oxide, or anodized, finishes are a most important group. A thin, inert, durable coating is formed which offers excellent protection from abrasion and corrosion. Some of the films are clear and can be dyed or painted. Others are naturally brown, gray, or silver in color.

The aluminum is made the anode in an electrolyte capable of yielding oxygen on electrolysis. After the initial oxide film forms, additional oxidation takes place *beneath* this film. The coating is minutely porous so that fairly heavy films can be built up.

In the Alumilite process sulfuric acid is the electrolyte. This is the method in largest use. Other anodic treatments use electrolytes of chromic acid, oxalic acid, sulfamic acid, and phosphoric acid. A boric acid electrolyte will produce a thin, non-porous film; it is used primarily where electrical insulating characteristics are desired.

One group of anodic treatments are used primarily for reflectors. These include electropolishing (or electrobright), Battelle, Alzak, and Brytal finishes.

Anodic coatings can be sealed after formation and coloring. Those formed with oxalic, sulfuric, chromic or sulfamic acid can be sealed by immersion in hot water at 180 to 212 F. Films treated with organic dyes are usually sealed in a solution of 1 to 2% nickel or cobalt acetate. Other sealing methods include treatment in a solution of sodium chromate or dichromate (which adds to the corrosion protection and oil sealing for non-seizing characteristics.

Several electroplating processes have been developed, of which the Zinc Immersion process is the most satisfactory. After vapor degreasing, alkaline cleaning, and a sulfuric-chromic acid dip, the parts are rinsed and immersed for 2 to 3 min. in a solution containing 525 grams of caustic soda and 100 grams of zinc oxide to 1 liter of water. Subsequent electroplating follows conventional practice.

Clad Finishes

Sheet and plate can be protected by bonding a thin layer of high-purity aluminum, or a special alloy, to the surface. This cladding not only protects the surface against corrosion but provides electrolytic protection that will prevent corrosion on the sheared edges or in spots where scratches cut through the cladding. Clad aluminum is known by such names as Alclad, Pure Clad, and Hard Clad.

Painting

Alloys such as A2 (2S), M1 (3S), GR1 (52S), GS21 (61S and R361) show better paint adhesion than alloys such as CG21 (24S), ZG42 (75S) and R303. A clad alloy takes paint as would a solid section of the alloy used for the cladding. When paint is applied for protection, proper attention must be given to cleaning, surface preparation, and selection of a primer.

Solvent-vapor degreasing followed by alkaline cleaning is probably the most satisfactory method of surface preparation. Sometimes the metal may be cleaned with solvent, prepared by one of the chemical treatments, or anodized.

Zinc-chromate primers possess the best corrosion-inhibitive properties. Lead pigments should be avoided. For service that is not too severe, aluminum paint is a good primer. When a lacquer finish is to be applied the primer designed for use with it must be applied.

Once the primer is applied, almost any durable exterior paint or enamel may be employed. These include oil-base paints, long-oil varnishes and enamels, synthetic-resin finishes, and aluminum paint made either with a long-oil varnish or with a synthetic-resin varnish.

Clear finishes which preserve the appearance of aluminum in outdoor exposure may be either lacquer or varnish. Lacquers must contain resins which are light-resisting (such as vinyl, and methacrylate resins), or they may contain cellulose esters. Some varnishes of glycerolphthalate resins have given good service but most common varnishes turn yellow.

Vitreous enamel coatings for aluminum have recently been developed. Because of the temperatures at which they are fired, the strength of the metal is affected. Coatings are glassy and brittle, with excellent adhesion.

We Appreciate . . .

The valuable assistance in collecting the data for this report given by the following firms and organizations:

Aluminum Association
Aluminum Co. of America
Aluminum Industries, Inc.
Apex Smelting Co.
Carboloy Co., Inc.
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Cincinnati Shaper Co.
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Federated Metals Div., American Smelting and Refining
Geometric Tool Co.
Hanson-Van Winkle-Munning Co.
Landis Machine Co.
Landis Tool Co.
National Twist Drill & Tool Co.
Nicholson File Co.
Norton Co.
Permanente Products Co.
Permold Co.
Progressive Welder Co.
Reynolds Metals Co.
Thompson Products, Inc.
Wyman-Gordon Co.

TALKING SHOP

Signs of the Times

YOU'LL see fewer campaign buttons this year; they cost 2¼ cents each, compared with ¾ cent in 1940. . . . On a vacated Saginaw, Mich., store: "We undersold everybody." . . . On a Newton, N. J., roadhouse: "Try our Forever Ambergers." . . . Remember the wartime signs about the bee, who flies despite proof that it's impossible for him? Well, stick with it the fact that a bee has to visit 56,000 red clover flower heads (each with about 60 flower tubes) to get enough nectar for a pound of honey. Each blossom contains less than ⅛ grain of sugar—and 7,000 grains make a pound.

Polidiction

LEGEND has it that Gladstone, seeing one of Faraday's inventions, asked of what possible use it could be. "Why, Mr. Prime Minister," answered Faraday, "you will soon be able to tax it."

Descaling

LUKENS STEEL is now descaling clad steel plates by the sodium hydride process, which reduces scale to metal or lower oxides, thus produces a uniform, unpitted surface. Plates, heated to 700 F., are lowered into a 700 F. bath of 1.2 to 1.7% sodium hydroxide in molten caustic. (Solution strength is maintained by feeding in hydrogen dissociated from ammonia gas to react with sodium.) Plates are dipped for 8 to 15 min., then quenched in water (where generated steam helps blast off scale). Plates are dipped in sulfuric acid to neutralize remaining caustic, brightened in a nitric-hydrofluoric bath, (Stainless is passivated in a nitric-acid bath). After this pickling, plates enter a water holding bath, then high-pressure spray to remove all acid, then a hot-water rinse.

Such treatment removes only scale, does not attack the backing steel, so dimensions are retained.

Iron Farm

EARLIEST ironworking installations were "iron plantations," consisting of mine, large surrounding forest to provide charcoal for fuel, waterpower for blast and other machinery, limestone, blastfurnace, forges and other shops and living quarters. A large blast furnace ate up a full acre of timber each day—so the three or four miners were far outnumbered by the wood-choppers and charcoal-burners. This was true until 1855—when the anthracite process came into common use.

In 1850, American production of steel was only 6,000 ingot tons; by 1900 it had jumped to 10,000,000 ingot tons—principally a result of development of the Bessemer converter and the open hearth.

July Idea

FEW MEN have read Benjamin Franklin's speech to the Constitutional Convention just before unanimous adoption of the Constitution. In its way, it is as striking a document of freedom as the Gettysburg Address. Here are extracts:

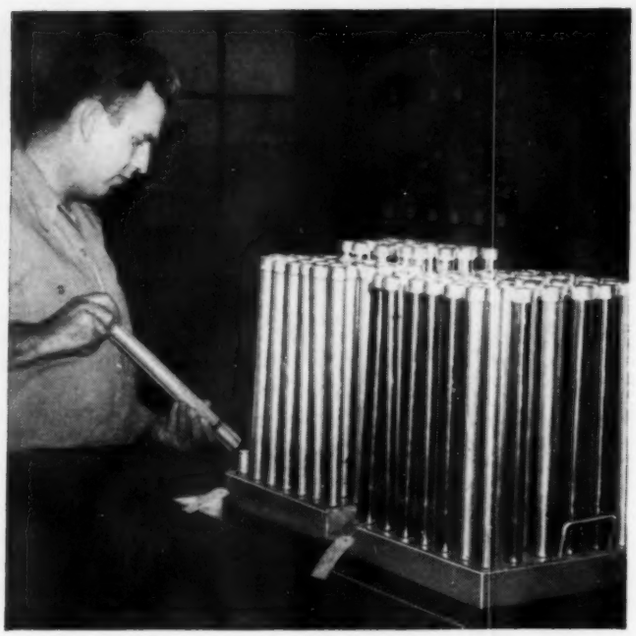
"I confess that I do not entirely approve of this Constitution at present, but I am not sure I shall ever approve it for having lived long, I have experienced many instances of being obliged, by better information or fuller consideration, to change opinions even on important subjects which I once thought right, but found to be otherwise. It is therefore that the older I grow the more apt I am to doubt my own judgment of others. . . ."

"In these sentiments, I agree to this Constitution, with all its faults, if they are such; because I think a general government necessary for us, and there is no *form* of government but what may be a blessing to the people, if well administered; and I believe further that this is likely to be well administered for a course of years, and can only end in despotism, as other forms have done before it, when the people shall become so corrupted as to need despotic government, being incapable of any other. I doubt too whether any other Convention we can obtain, may be able to make a better constitution; for, when you assemble a number of men, to have the advantage of their joint wisdom, you inevitably assemble with those men all their prejudices, their passions, their errors of opinion, their local interests, and their selfish views. From such an assembly can a *perfect* production be expected? It therefore astonishes me to find this system approaching so near to perfection as it does. . . ."

Steel Sandwich

CLAD STEELS—a light layer of nickel, stainless, Inconel or Monel permanently bonded to a backing plate of ASME specification steel—have always intrigued us. Not long ago, we visited Lukens to see them made. The job is simple—if you know how. Two slabs of steel are each smoothed and topped with an insert of the cladding metal (previously electroplated with nickel if stainless or Inconel). The assemblies are made into a "sandwich" with the two cladding slabs separated only by a secret paint-like parting compound. They are sealed together by automatic welding strips of the cladding material around the edges of the insert, then rolled in the 206-in. mill. After rolling, the "sandwich" edges are trimmed and it is opened readily. Such sheets may be 178 in. wide; some have even had silver cladding or both sides clad.

Bearing assembly benches, where ball bearings are pressed onto the ends of motor armature shafts, are designed for fast operation. Ball bearings, delivered to the benches in capped tubes, are moved out of a slot in the side of the tube by an air plunger when needed. The operator at this work station also places grease in bearing caps, shown lined up on the work bench



To insure delivery of clean ball bearings to the motor assembly lines, the bearings are stored in a closed room equipped with air cleaners. As needed, the bearings are placed in capped tubes set vertically on trays which are moved by truck to the bearing assembly benches. Each tube holds 35 bearings and is slotted for easy removal of the bearings one at a time

TUBES KEEP BALL BEARING CLEAN

Vending-machine technique used by Electrolux speeds assembly and insures clean bearings. Air plunger pushes ball bearings from closed tube directly into the hand of the assembler

BY A. M. MURRAY
WORKS MGR., ELECTROLUX CORP.

ASSEMBLY of two ball bearings to the shafts of Electrolux vacuum-cleaner motors is performed at work benches placed beside the motor-assembly carrousel conveyor, so bearings can be assembled to shafts immediately preceding placement of the rotors in the motor housings. The possibility of dirt or grit getting into the bearings before they can be protected by seals and endplates is thus minimized.

Further to insure cleanliness, bearings are kept in a separate air-cleaned room until needed by the assembly group. Then, they are delivered in sealed tubes, each containing 35 bearings. These are transferred to the assembly benches on trays holding 49 tubes. Because two sizes of ball bearings are used, one for the commutator end, and one for the blower end, separate tubes and trays are provided for each size.

Tubes are transferred from the trays to racks at the two bearing assembly stations. Each rack holds five tubes.

Each tube is slotted near the bottom so bearings can be removed one at a time as needed. Behind the slot is a small hole through which a plunger enters to push the bearing out so it can be grasped by the operator's fingers when she is ready to place it on the end of the shaft. This ejecting plunger is operated by a small air cylinder mounted horizontally on the work bench behind the tube-holding fixture. It is controlled by a pedal valve under the bench.

Bearing assembly fixture on the work bench is tilted slightly so it is convenient for the operator. The bearing is placed on the end of the shaft with the left hand while the right hand moves a lever to force a plunger against the bearing and press it on the shaft.

Rotors are delivered to the first bearing-assembly station in the trays used in the rotor-assembly department. The operator at the first bench replaces rotors in these trays for movement to the second bench, from which they are delivered directly to the motor-assembly conveyor. Since several thousand of these motors must be assembled each working day, considerable attention has been given to the design of bearing-assembly benches to facilitate production operations.

BRUSH ANODIC FILMS ONTO LOCAL AREAS

You will recall the electrolytic brush for repair jobs on nickel plate . . . The same idea can be used to anodize aluminum and magnesium

By E. SIMON and F. W. THOMAS
Chemical Research Engineers, Engineering Research Div.,
LOCKHEED AIRCRAFT CORP.

THERE are times when conventional tank anodizing is impractical. For example: Immersion is not suitable when the assembly contains dissimilar materials—metal, wood and plastics. And in other cases, rework or modification of a metal assembly may destroy only a small percentage of the protective film. Here, either the assembly must be dismantled or protective stop-off material applied.

But with suitable portable equipment, an anodic film can be quickly applied to a local area of an assembly. Most convenient method is to use the "Brush Anodizing" process (patent applied for). True, there are situations where it is preferable to apply electrolyte-soaked pad to a fairly large area that requires an anodic film.

Equipment necessary for brush anodizing (Fig. 1) consists of: an anode terminal *A* clamped or otherwise fastened to the work; a brush anodizing gun, *B* or cathode; a pressure-feed tank *C* for supplying chromic acid to the gun; a voltage control *D* which

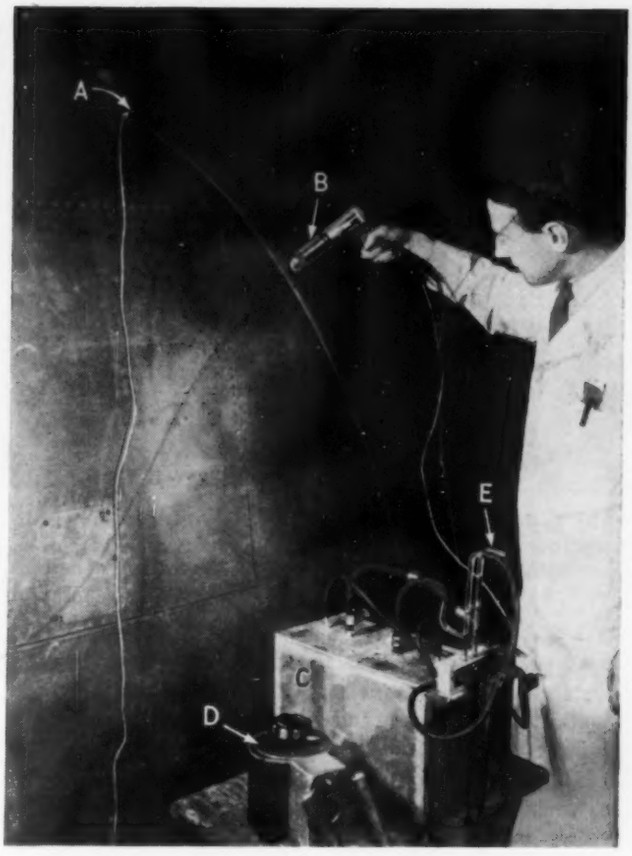


Fig. 1—Local areas denuded of a protective anodic film can be quickly repaired with simple, portable equipment, and without dismantling the assembly or using an unsuitable immersion method

is in this case a Variac of the O-130 v. type; and a manometer *E* to govern the pressure-feed tank.

Details of the gun are disclosed in Fig. 2. Here the components are: a gun head with trigger feed to control flow of the electrolyte; three brush heads of various styles that can be screwed into the gun head, and a special wrench.

Various absorbent materials can be used in the brush heads. Fiberglas blanket, Type XAAPF; du-

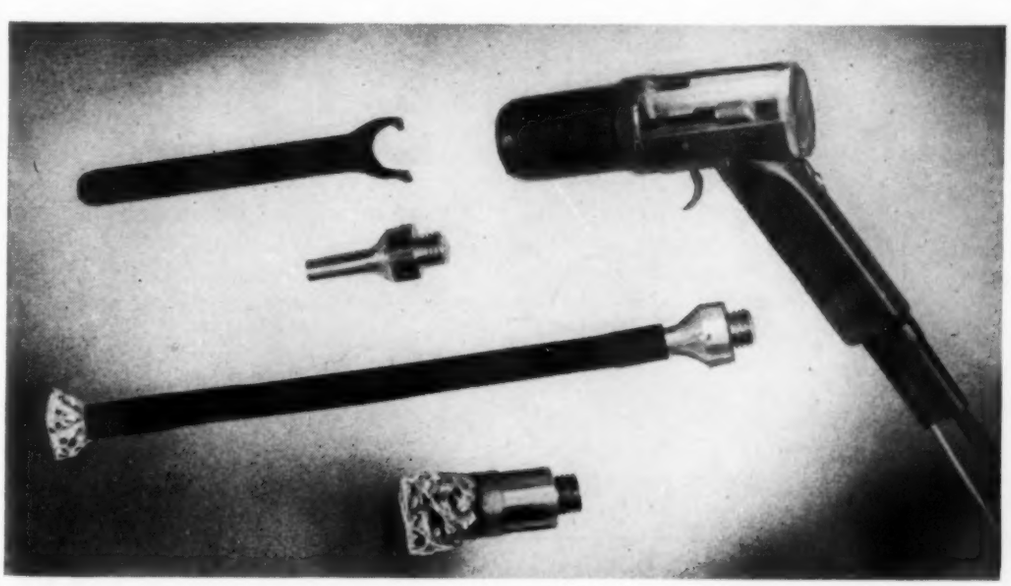


Fig. 2—Brush heads of appropriate length and surface area are used for applying electrolyte and current to various surfaces. These are screwed into the plastic gun head. A power lead and a chromic-acid feed tube are connected to the handle

Fig. 3—Renewal of an anodic film over a large area can also be achieved by fastening in place an electrolyte pad soaked with a saturated aqueous solution of sodium bisulphate and a cathode of sheet lead or aluminum

Pont Cellotex sponge and soft sponge rubber have been used. The pad material must be resistant to the corrosive action of chromic acid and have suitable abrasion resistance to withstand wiping over the work surface. Metal parts of the gun are sheathed in Micarta to prevent a short between the gun and work.

The power lead from the gun is connected either to a dc. generator with a voltage range of 75 to 150 v., or to a Variac voltage regulator connected to an 110-v. alternating-current source.

Operation of the Brush Anodizing process is governed by the electrolyte concentration, temperature, voltage, number of brush strokes and current density. For most work on duralumin, the electrolyte concentration will vary from 3 to 5% chromic acid by weight. Use of a higher concentration produces excessive heating, arcing and pitting during operation; low concentration requires an excessive number of brush strokes. Temperature, voltage and amperage are governed by the working area of the brush and the type of power supply. Performance data for various conditions are given in table.

Applied in a Moment

One favorable aspect of Brush Anodizing is the short operational time involved. In the immersion process, the customary time is ½ hr. at a current density of one ampere per square foot of work area. But only a few seconds are required to produce a brushed anodic film possessing appreciable corrosion resistance, because the operating current densities (over the small areas involved) are from 250 to 1000 times greater than employed in a tank.

It is possible that the Brush method produces a more dense and uniform film than the tank process. Since in the latter, oxide formation may proceed beneath the film first formed, a more porous oxide structure may be produced. It is reasoned that this effect may be produced by long contact of the electrolyte with the outer oxide layer, especially when the electrolyte has an appreciable solvent action on freshly formed aluminum oxide. In addition, with tank methods, using low voltage and amperage, the $CuAl_2$ constituent of alloys like 24S may be more readily attacked than the aluminum matrix, produc-

INFLUENCE OF CHROMIC-ACID CONCENTRATION AND OPERATING VOLTAGE ON 24S-T DURAL

NO.	ELECTROLYTE	AMPERAGE INITIAL (1ST STROKE)	AMPERAGE FINAL (20TH STROKE)	FINAL VOLTAGE**	SALT SPRAY TEST RESULTS	OPERATION NOTES DURING ANODIZING
1	1 gm CrO_3 per 100 cc H_2O	2.2	0.7	86	Fairly Good	Satisfactory
2	"	2.6	0.7	102	Good	"
3	"	3.0	0.8	130	Good	"
4	"	3.5	1.1	150	Good	Electrolyte warm
5	"	4	1.3	170	Fair	Excessively hot-arcing-pitting at start of stroke
6	3 gm CrO_3 per 100 cc H_2O	3	1.0	90	Good	Satisfactory
7	"	4.2	1.5	92	Good	"
8	"	10	2.5	135	Fairly Good	Electrolyte hot
9	"	23	2.5	190	Fairly Good	Arcing
10	5 gm CrO_3 per 100 cc H_2O	5	1.3	92	Fair	Satisfactory
11	"	7	1.7	93	Good	"
12	"	9	3.2	120	Fairly Good	Pitting at start of stroke
13	"	15	5	170	Good	Arcing
14	10 gm CrO_3 per 100 cc H_2O	18	4.5	90	Good	Satisfactory—no pitting
15	"	20	6.5	124	Good	Electrolyte hot-pitting at start of stroke
16	"	25	7.0	137	Good	Not practically operable

D. C. was used as the energy source in all cases. ***Brush Area—1 in. square.*

ing a preferential effect that restricts practical film growth.

Other factors which have definite bearing on the physical characteristics of the anodic film are electrolyte type, electrolyte concentration and operating temperature. These have been investigated only in a preliminary manner; they are important because they may establish limiting operating conditions.

One practical effect is derived from what is known as the "spark voltage", which is dependent on the type of valve metal and the type and concentration of the electrolyte. In the commercial process for anodic oxidation of aluminum, the spark voltage is not reached. Conditions are controlled so that the velocity of oxide formation is greater than the solution velocity, thus precluding the need for excessive voltage increase.

In the Brush method, however, relatively high voltages are used to overcome resistance effects. Since temperature rises rapidly with forming voltage and in turn the solubility of the aluminum increases rapidly with increase in temperature, a point is easily reached where the oxide solution is equal to the oxide formation. This represents an apparent maximum voltage since progressive oxide growth is stopped. In many cases this may occur in the region of the true maximum voltage, where the aluminum is only very slightly soluble, when a spark discharge occurs. Reference to this effect has been previously noted in the table (labeled sparking and arcing). This condition can be avoided by the proper selection of voltage, electrolyte concentration and number of strokes.

Further experimental data are required to evaluate the relative merits of ac. versus dc. anodizing. But preliminary results have been encouraging. Coatings that appear at least comparable to those obtained with direct current have been obtained by the Brush method with a 3% aqueous solution of chromic acid at normal line ac. voltage (110 v. or less). This procedure reduces the equipment required to a minimum and places it in the classification of a soldering iron for simplicity of use.

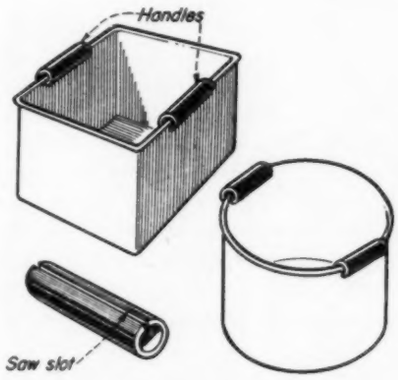
Not Confined to Aircraft Work

Principal applications of the Brush Anodizing process have been to protect denuded areas of previously anodized dural surfaces occurring integrally as part of an assembly incapable of being tank anodized. Anodic films produced by this method can also be used to give increased adhesion to primers, paints and adhesives applied to duralumin surfaces. Tests to determine the effect with resin adhesives show a considerably increased shear strength. The principle of the saturated pad or brush is readily adaptable to large or small scale installations. Its use need not be limited to aircraft processing but may be considered as an accessory in other fields.

The Brush Anodizing process is also adapted for use on magnesium. Anodic films so produced will impart corrosion resistance comparable to the chrome-pickle treatment The electrolytes used consisted of mixtures of ammonium, tungstate and vanadate salts and chromic acid, adjusted to a pH of 7. Further investigation must be made before this application can be more completely evaluated.

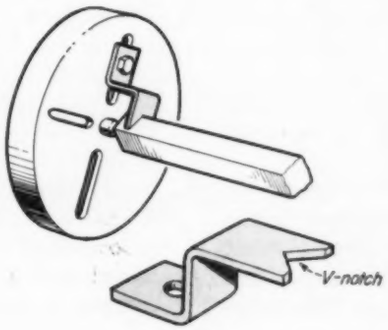
Short Cuts FOR THE SMALL SHOP

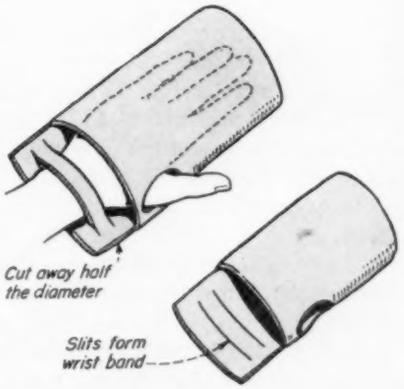
BY A. H. WAYCHOFF



GASPIPE HANDLES work well on tote boxes. To make them, cut a lengthwise slot in gaspipe pieces about 3 to 4 in. long. After spreading the pipe, apply it to the beaded edge of the tote box and close with a hammer. Wood boxes might be recessed and the gaspipe handles applied. The handles make for a surer grip when the container is used for a heavy load of parts.

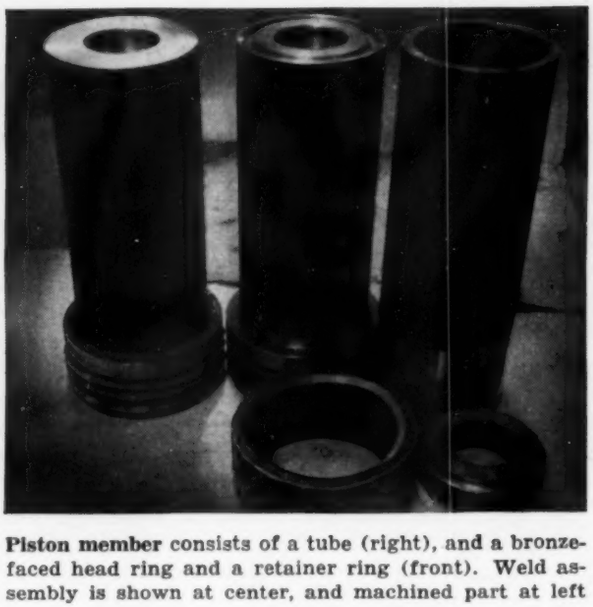
A HANDY DRIVER for square or hexagonal stock can be made from a piece of flat bar. Bend up as shown, drill for a T bolt to fit the faceplate slot, and cut a notch in the other end to engage the work. A v-shaped notch is satisfactory for square work and often for hexagonal stock, but for the latter a hexagonally shaped notch might also be made.





RUBBER MITTS for rough shop work cost nothing if made from an old auto inner tube. Cut pieces longer than the distance from your fingertips to wrist. Cut a thumb hole in one side, remove half the diameter at the rear of the mitt, then cut two slits in the remaining half. The slits produce a loop to go over the wrist and hold the mitt snugly in place.

Three steps in fabricating a hydraulic cylinder are: (Center) honed-to-size tubing, and bronze-faced ring; (left) ring shrunk into place; (right) ring welded flush in two passes



Piston member consists of a tube (right), and a bronze-faced head ring and a retainer ring (front). Weld assembly is shown at center, and machined part at left

MANUAL HIDDEN ARC WELDS HOIST CYLINDERS 300% FASTER

BY AL BLEWETT
PRESIDENT, OHIO ICE MACHINE CO.

BY replacing conventional hand welding with manual hidden-arc welding, the Ohio Ice Machine Co., Cleveland, has increased production of hydraulic hoists for dump trucks by 300%. In addition, improvement in weld quality brought about by the new process eliminated leaks from porosity and facilitated subsequent machining of the welds.

The cylinder is made from relatively high-carbon (0.4) steel tubing, 8 in. O.D., with a ¼-in. wall. First operation is to bore the tubing (removing ⅛ in.), and to finish by honing (removing an additional 0.03 in.). An insert ring of SAE 1020 seamless-steel tubing, ¾ in. thick and 2 in. long, is then shrunk into one end. In machining the ring, a straight scarf is put on the O.D. so when inserted there will be a V-groove for welding, ¼ in. deep and ¾ in. wide.

A ¼-in. deposit of bronze is applied to the inside of the ring, after which the ring is welded to the tube with the manual Lincolnweld. The weld is made in the ¼-in. groove in two passes with a machine setting of 325 amp. and a speed of 32 ipm. The operator removes the flux with a vacuum pickup and chips off the slag with an air chisel, so the two passes can be made without interruption.

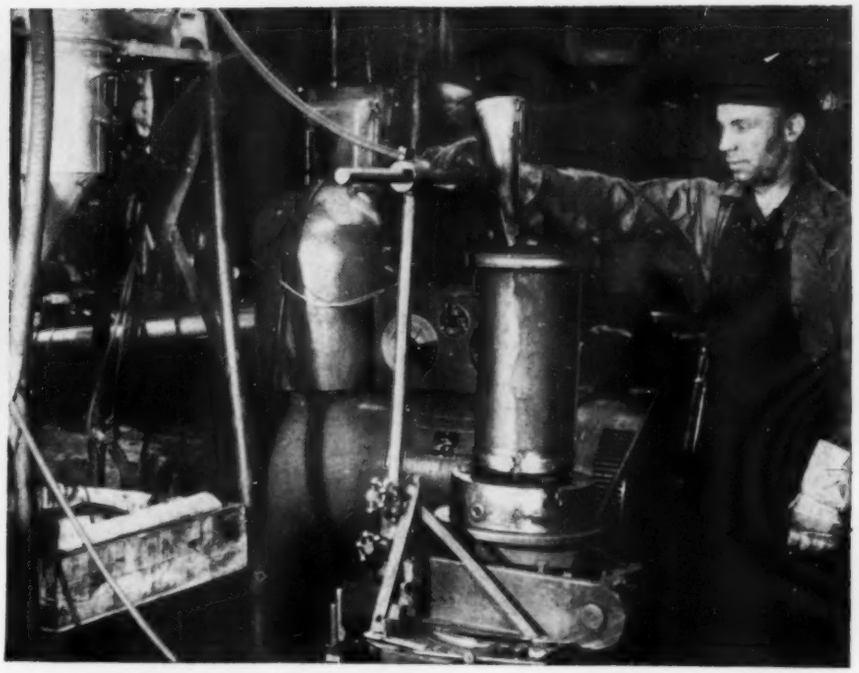
All welding is done on the cylinder after the inside has been honed to finished size, as no difficulty is experienced from distortion. After the insert has been welded, the end of the cylinder and the inside of the insert are faced, and the bronze machined to leave a deposit of ⅛ in. Final operation is to grind the O.D. of the cylinder to a limit of ±0.001 in.

Welding time is 5 min.; a substantial reduction over the 20 min. required for ordinary manual welding with a 3/16-in. electrode. Moreover, the weld is flush and not only requires less machining to face it, but is easier to machine because of its uniform quality.

The piston member of the hoist is made by scarfing the I.D. of a section of steel tube and applying a deposit of bronze to the O.D. to form the head. This is shrunk on to a second piece of tubing forming the trunk, and welded by a buttweld on the end and a fillet weld. Both welds are made in one pass each at 325 amp. and a speed of 15 ipm.

The I.D. of the piston is bored and the ring grooves in the bronze rough turned. The bore is then honed and a retainer ring, previously turned and scarfed, is welded into the end of the tube opposite

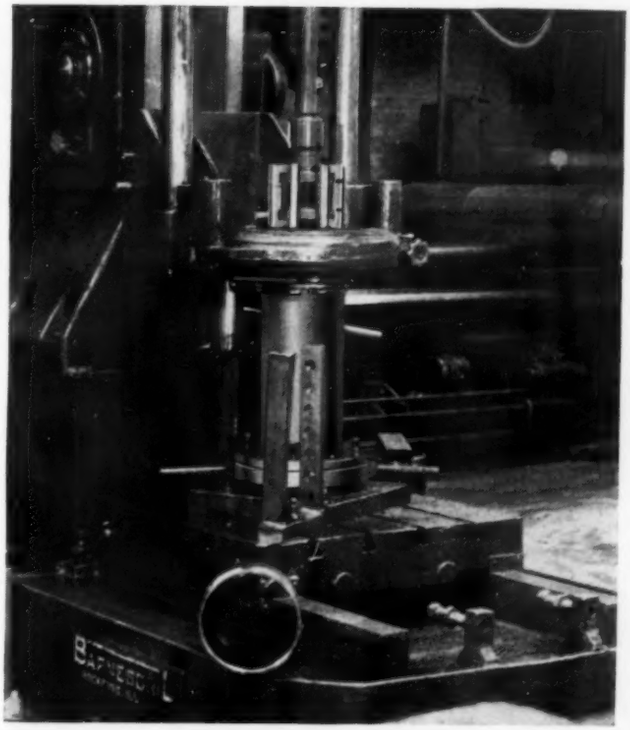
Flux dam is made by trepanning the center from a large carbon disk, and arranging the two pieces as shown. Slag and flux are removed immediately to avoid interrupting second pass



Welding gun is mounted on an adjustable arm and work is revolved under the gun. To start, wire is inched down to touch the work, and fixture rotation started by foot switch

the one on which the head ring has been welded. The retainer is welded in two passes, the V-groove between the ring and the tube being ⅜ in. deep. The retainer is next faced inside and out and bored, the O.D. of the tube turned, and the ring grooves finished. Final operation on the piston is to grind the O.D. to the finish diameter.

The three welds on the piston were previously made by conventional hand techniques in 40 min. They are now completed in 10 min. The fillet weld originally required two passes, while three passes were needed to fill the groove between the retainer ring and the tube.



Cylinder barrels are finish machined, including honing, before welding is done. High current density and fast operation produces smooth welds and eliminates distortion

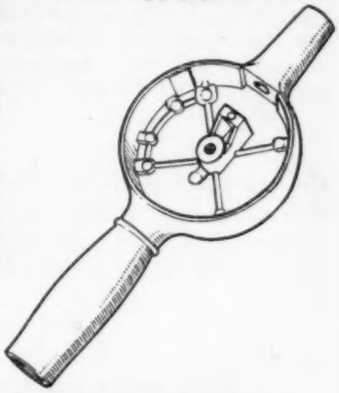
The manual Lincolnweld unit employed is the latest development of Lincoln Electric Co., and is a portable, self-sufficient unit providing all the necessary welding current and auxiliary power, plus automatic wire feed and controls. Basic element is a standard 600-amp. welder that can be used for either regular manual welding or for hidden-arc manual welding. Mounted on this is a unit containing the wire reel, feed mechanism, drive motor and voltage controls. A special cable and a cone-shaped welding gun complete the equipment.

The electrode wire is fed to the work automatically through a granular flux deposited by gravity from the welding gun. It passes through a special channel formed in the center of the cable, which thus forms a light, flexible carrier for both welding current and electrode wire.

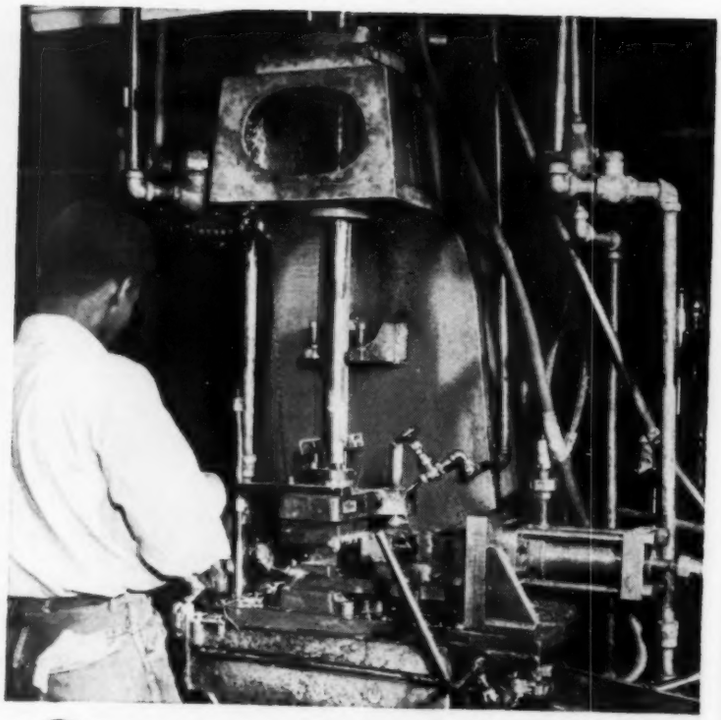
Constant arc voltage is maintained automatically, independent of the height of the gun above the work, so the gun may be raised or lowered to regulate the flow of flux. Because wire is fed through the gun nozzle at approximately 300 ipm., and because current is introduced to the wire close to the arc, it is possible to use as much as 600 amp. with only a 5/64-in. electrode. Current densities used with this equipment are said to be higher than have ever been used before, and concentrate heat sufficiently to weld ¾-in. plate in a plain butt joint, one pass each side, without edge preparation. These densities and speeds produce dense and smooth-appearing welds, free from hydrogen and low in cost. Welding in high-carbon, low-alloy, high-tensile steels is facilitated, and distortion minimized.

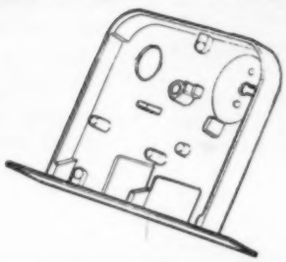
SHOP

Combination machine developed to finish aluminum die-cast handles for hand drills trims parting line in hydraulically operated die. Part is positioned for reaming and tapping with tools in three Kingsbury heads. Fixture cylinder operates from 1,100-psi. shop hydraulic supply lines



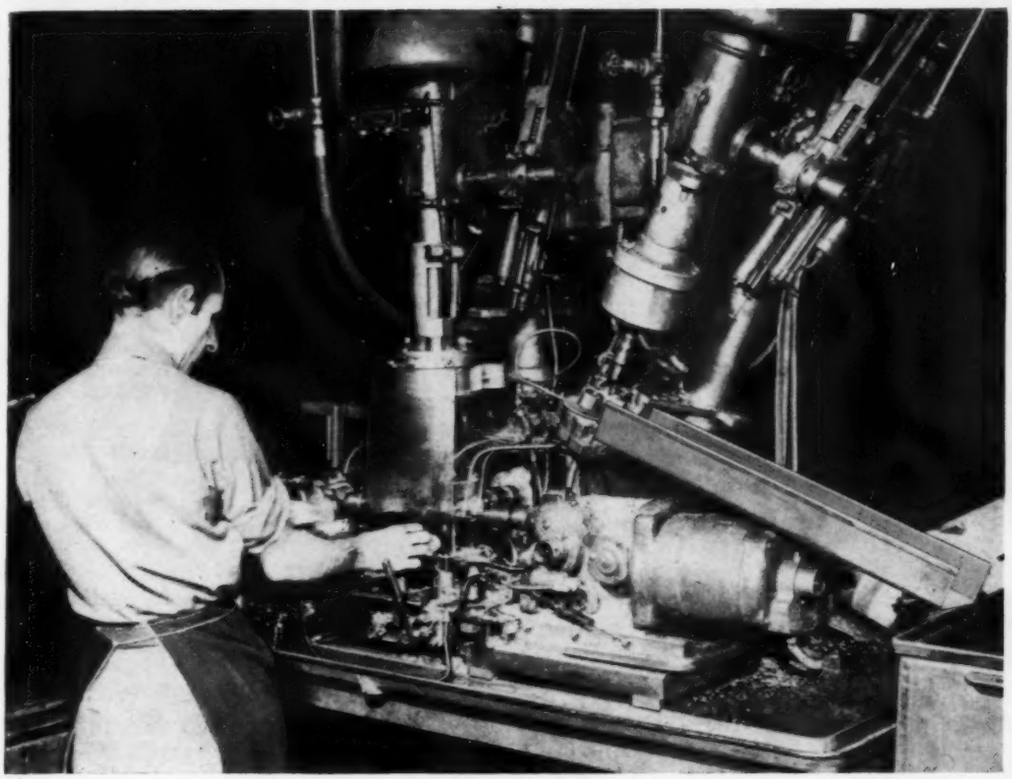
Aluminum die-cast housing for movie camera is machined on inside surfaces with end mill in this No. 18 Buffalo drill-press setup. Fixture moves between rails on table to guide part past rotating cutter. Air nozzle keeps table clean of chips

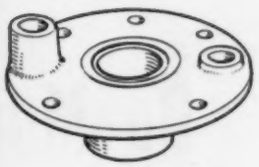




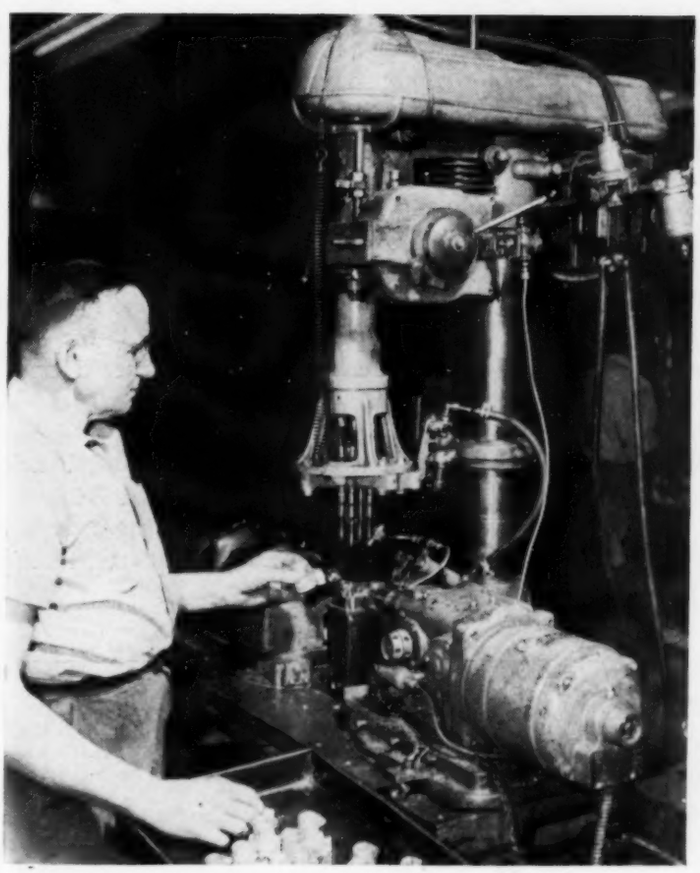
Top ram of hydraulic press trims sides of door-lock case and holds it while side ram trims face. Punch on top ram has ears to support flanges of casting while side punch trims edges of face. Production averages 7,500 parts per 8-hr. day

SHOTS FROM STEWART DIE CASTING





Two - station special machine developed by Stewart engineers reams two holes and spot-drills three holes at first station, taps one hole at second station. Part is zinc washing-machine die casting. Production is 375 per hr. Air valve in front of operator locks the two jigs. Operator trips two other air valves to start the three Kingsbury horizontal spindle - heads and the two Senacon feeds on the Buffalo drill units



Aluminum die-cast gas-burner rings are trimmed at 5,000 per hour in this setup employing Buffalo drillpress heads and carbide-tipped cutters. Spindles operate at 1,500 rpm. Foot-operated ejectors lift trimmed parts to chutes at rear while operator moves two new parts into position into fixtures. Senacon air feeds for spindles are stripped by Mead air cylinders controlled by safety valves in front of operator

Special machining unit has two Model 18 Kingsbury heads and a Walker-Turner drillpress with a Commander 5-spindle drill head. It machines parts for a Stewart-Warner speedometer at 500 per hour. Kingsbury heads face sides of part

ROUND TABLE

Do Morals Affect Morale?

Al walked in whistling, "What a girl; what a night!" Ed paid no attention, so Al let the cat out of the bag: "Happened to meet up with that blonde on the drillpress last night just as I was going to lodge, and we decided to go out for a ride."

"Hummmm! Stepping out on Mabel, eh?" Ed grumbled. "You don't mean the little blonde in your department, do you? I saw you out there talking with her last Friday. Looked to me as though considerable business was being discussed —company business, of course—don't misunderstand me, Al!"

"No, I won't!" snapped back Al. "What're you doing, holding a stopwatch on me?"

"Not exactly, Al; but I wasn't the only one taking things in—some of the boys were making cracks as I passed. One fellow mumbled that it certainly had its advantages to be a foreman. Even old Brown, the grandfather of six, remarked that he wished he was the boss and could get around. And some of the younger men—well, their leers made it pretty obvious where their thoughts were jumping."

"It's nobody's damn business, Ed, what I do or who I talk with!"

"Oh, yes it is, Al! You're the foreman, you know."

"Can't a foreman have a little fun occasionally? We're not school teachers, you know. A fellow's got to have a little freedom once in awhile, hasn't he?"

"Not that kind of freedom, Al—not on the job, anyhow."

"I suppose a shop foreman has to be one of these goody-goody boys who preens his wing feathers now and then, eh! Well listen to me: If I want to go out with the blonde, that's my business. If I want to talk with her in the shop, that's nobody else's business either as far as I can see."

"But Mabel's!" laughed Ed. "Can't you see, Al, how some of the boys will have you over a barrel? And when a foreman is over a barrel, he loses his effectiveness as an executive, doesn't he?"

"Ah, you're too darn technical, Ed."

"Think I'll do a little research around bench nine myself in a little while," laughed Ed.

"O.K., Wise Guy, but don't go opening your big mouth while you're doing it! Just remember that's my department."

MOST HUSH-HUSH, *but most rumor-mongered, is the relationship—real or fancied—between Boss and female employee. What rights has an executive? Must he submerge his personal inclinations to be competent administrator? Should he take advantage of his position? Your opinions and experience will help others. Discussions of earlier topics appear on later pages.*

PORTABLE STEAM GENERATOR CLEANS PRESSES

Designed specifically for removing shop dirt from machine tools and presses, a tiny steam generator finds many useful applications

BY BRADLEY C. HIGGINS
Worcester Pressed Steel Co.

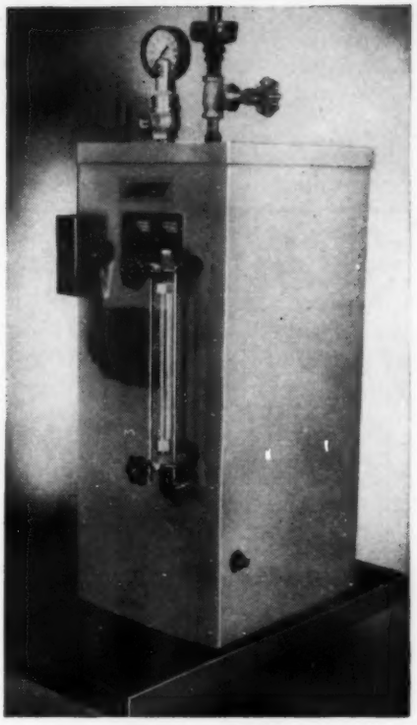
KEEPING production machines clean is a problem in every metalworking plant. All too often, lathes, drillpresses, milling machines, presses, and other equipment accumulate too much grime. Cutting fluids and lubricating oils used in the machines and on stampings add their quota, until layers of dirt are built up to the point that some machines are scarcely recognizable, and machine numbers and labels giving motor specifications and operating data are completely obscured. Breakdowns involve handling messy parts; cracks in press castings are hidden, and not discovered until too late; improper light is reflected on the work, and accidents, eyestrain and mistakes result; and production drops off as the day progresses.

The Worcester Pressed Steel Co. recognized the importance of this maintenance problem and undertook to find a practical method for cleaning presses and other tools. The results of its research program were first reported at a meeting of the Pressed Metal Institute, New England district, and are here presented.

Various types of soaps were tried, without much success. Naphtha-base compounds were tested, but the fire hazard was feared. Compounds mixed with kerosene were sprayed on machines with a garden-type sprayer but were too messy on wood floors and could not be used in many departments. Compressed air was tried to increase the coverage, but the mist and fumes were objectionable to workers and presented a fire hazard. Finally, it was decided to try steam. Several problems, however, had to be solved. The shop steam lines supplied only 12 psi., and 40 to 200 psi. were needed. It was undesirable to burn fuel inside the plant, with the accompanying worry about gases, fumes, soot, filters, fuel pump and fuel storage tank, together with a stack to absorb heat. Immediate control of 40 to 200 psi, or more, was required to fit the specific need. High efficiency of the steam generator was important and it was desirable that the unit be portable so it could be moved about the shop between the presses, and the aisles kept clear. Other desirable features included minimum maintenance, which ruled out electric heating coils or oil-fired units, as these may burn out and cause delays; one-man operation; and low original cost.

Steam cleaning, however, seemed to be the only answer to the problem, and a steam generator was finally invented by the author to meet the requirements listed above. Its basis of operation can be compared to electrolysis but there are a few important differences. It is, indeed, akin to the familiar electric vaporizers used in sickrooms, and generates the steam by the resistance of the boiler water to the flow of current between two electrodes inside the boiler. The generating unit consists of electrodes, relay, tank, pipes, safety valve, pressure gage, and a few other attachments. Operating power is obtained by plugging in to the shop electric circuits at convenient points.

The unit draws about 20 amp. on 550 v., based on 4 to 5 min. to build up steam pressure. If the time is increased to 7 or 8 min., the amperage is considerably less. The first 3½ days operation of the unit, current was on only 2 hr. 20 min., and the total cost for power was less than $1. Labor cost was $33. The same job performed by older methods would have cost $200.

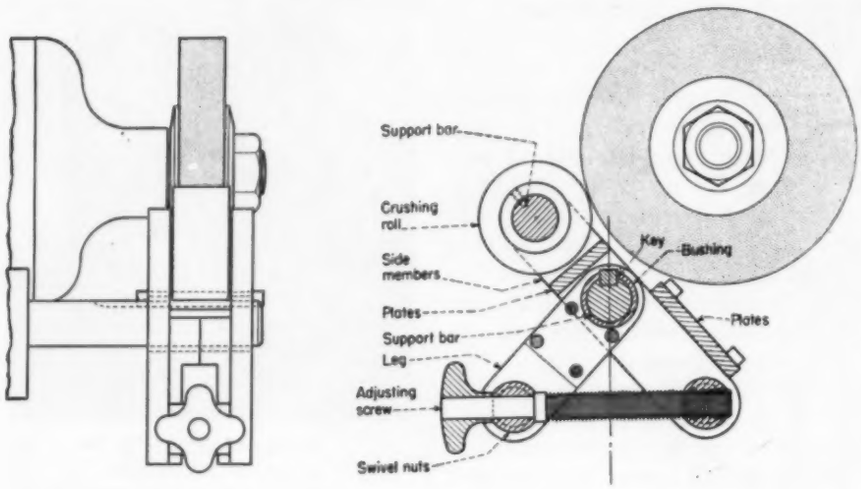


Designed originally for cleaning presses, this electric steam generator weighs only 54 lb. and measures 8½x12½x18 in.

The heat of the high-pressure steam causes rapid drying of the metal, there is no condensation and no rusting, and if desired, a team of painters can follow directly after the cleaner. Strong or weak soap can be used merely by changing the contents of the pail of atomizing solution. Only two precautions are necessary: (1) to use a small amount of sawdust on upper floors, and (2) to plug with rags the open ends of some motors and switches.

The generator is highly versatile. It can be used to clean out pits under presses, to help dry cup-shape stampings that retain water after washing, to melt grease on cold days, or melt snow and preheat oil for large boilers. Where hot water is needed, it can be brought into use, or it can be coupled to a radiator to service cold spots during the winter. It will produce 9 lb. of steam per hr. with 110 v., or 18 lb. with 220 v. Under the name of Speedylectric, the generator has now been made available commercially from Livingstone Engineering Co., Boston.

Practical Ideas



Dressing Attachment Crush-Forms To True Grinding-Wheel Surface

Crush dressing, a relatively new principle, is adapted for dressing grinding wheels in this attachment. The danger of flying particles to man and machine is eliminated, and a straight and true edge is formed with its use.

Crush forming is accomplished in this case by forcing a mild-steel wheel against the grinding wheel. This was chosen because it could be driven against wheels that would crack and fracture under hardened steel dressing. Several months of use showed no noticeable wear in the steel part.

The tool is mounted on the tool-rest support bar of the machine—a tool grinder. This bar is machined for a keyway.

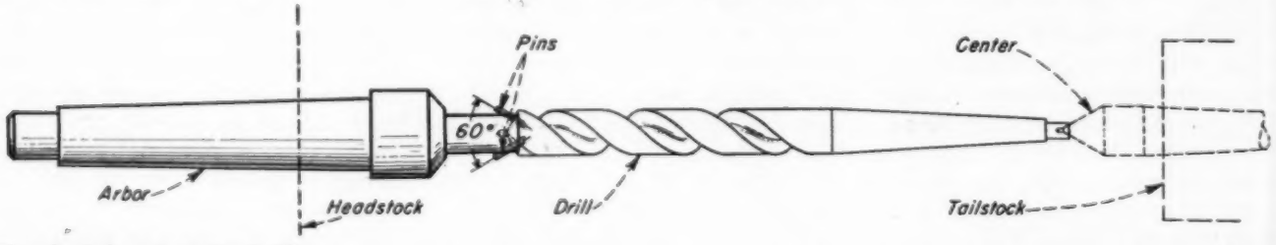
The 2½-in. dia. crushing roller rides on a hardened and ground spindle. Two side members, mounted on a bushing on the support bar, hold the spindle shaft at their upper ends. A swivelling nut is retained by their lower ends. The members are held together by plates on the lower ends and near the crushing wheel.

A leg carries an adjusting screw and swivelling nut. This leg is keyed to the support bar, while the side members are free to turn. Tightening the adjusting screw brings the lower ends of the side members closer to the screw and forces the crushing roll into the grinding wheel.

To use the dresser the tool rest is slipped off the support bar and the dresser is put in its place. Grinding is done by rotating the wheel by hand, or through a crank, and forcing the roller into contact. A true shape is maintained by moving the crushing roll back and forth across the wheel. A stiff wire brush can be attached to the machine to clean out abrasive particles which become imbedded in the roller. *Clifford T. Bower, Decatur, Georgia.*

"Painting" Cuts Heat-Treat Scale

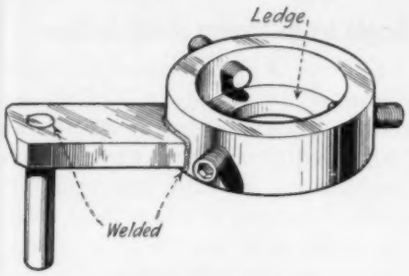
A simple but effective method of eliminating the formation of the flaky scale on tool steel during hardening is to coat the work with a mixture of lampblack and linseed oil. The mixture is made to about the thickness of paint so it can be applied with a brush. Careful handling and slow heating are required to avoid cracking the coat during the heating process. The coat hardens during the quench and is easily removed. *Roger Isetts, Kenosha, Wis.*



Simple Arbor Sets Up Drill For Grinding O.D. and Shank

Mounted between this 1020 steel mandrel and a tailstock center, drills can be finished on a cylindrical grinder. Two pins resting in slanted holes in the end of the mandrel fit into the flutes of the drill and provide a positive drive.

The mandrel shank is ground to fit the machine taper. The front mandrel end is countersunk to fit the ends of drills, and the two pins are located perpendicular to the countersunk face. The setup insures true-running drills, and eliminates the trouble of chucking. *Milton J. Curcio, Racine, Wis.*

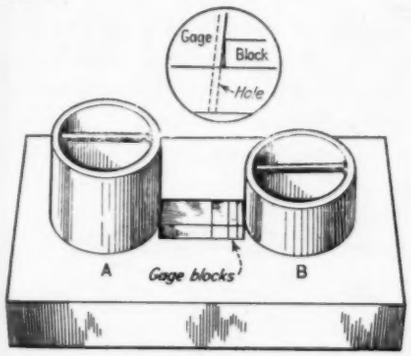


Dog Clamps End of Work

Punches that we make have long, slender heads that make it impractical to use standard lathe dogs. Special dogs were made to hold the punches for turning and milling operations.

Made in many sizes, the dogs have been found useful for any work that has to be held close to its end. The bodies are bored from solid stock and the tails are welded in assembly. Three small setscrews used for tightening drive a surprisingly heavy load.

The ledge inside the hole helps in squaring up the dog, besides keeping the dog at the end of the work. *George Wilson, Mankato, Minn.*



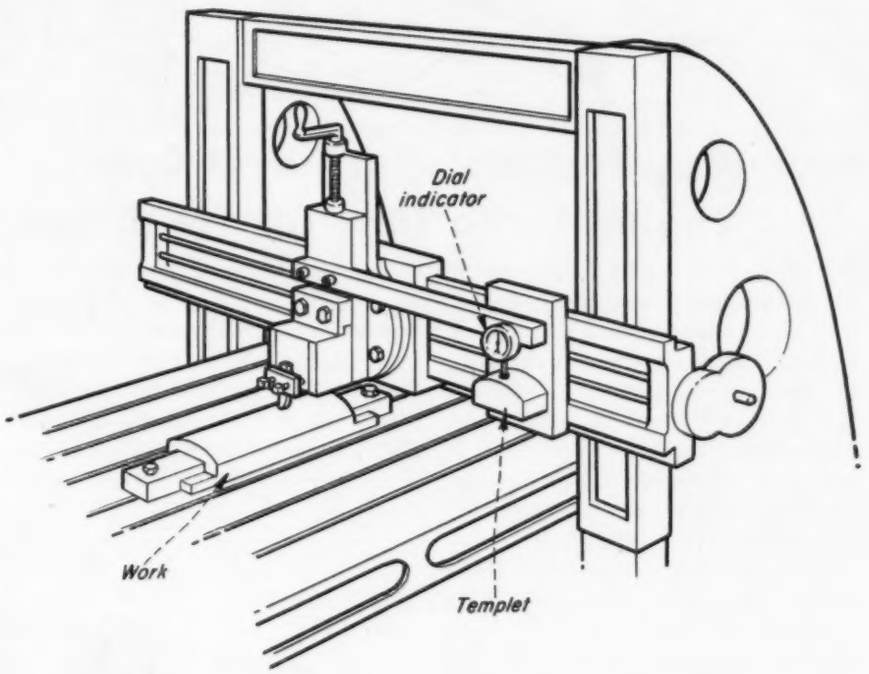
Plug Gage and Gage Blocks Measure Center-to-Center

Center distances of two holes, either the same or different sizes, can be checked accurately by laying gage blocks between hollow, tapered plug gages. The gages themselves are tapered 0.036 in. per ft.

When a plug gage is placed in a reamed or bored hole, with its larger diameter up, the actual bored diameter can be read by measuring the height of the gage top above the lip of the hole. It is calculated from the taper of the gage and the nominal, or top, diameter. As illustrated, the gages are fairly thin-walled and have light handles welded inside their ends — placed there before the gages are ground.

Checking the center distance is done by adding half the diameters of both holes to the dimension of the gage blocks that are laid between the gages. Thus, if gage A is 4.995 in. in diameter at its top and its height is 4 in. above the surface, the hole diameter is 4.983 in. The second gage, B, might be lower in its hole, with only 1 in. showing, so the second hole has a 4.992-in. dia. If the gage blocks are 1 in., ½ in., ¼ in. and 0.137 in., the total center distance is 6.8745 in.

However, this is not strictly true. If the gage blocks are all ⅜-in. thick, the contact between them and the plug gages is not at the hole lip, but ⅜ in. above it, and this will make a total error of 0.00225 in., which must be added to the previous total—making 6.87675 in. the final reading. This, obviously, is too close to be practical, considering the probable accuracy of the plug gages. The final figure should be considered, in this case, to be 6.877 in. *Dale E. Hess, Baltimore, Md.*



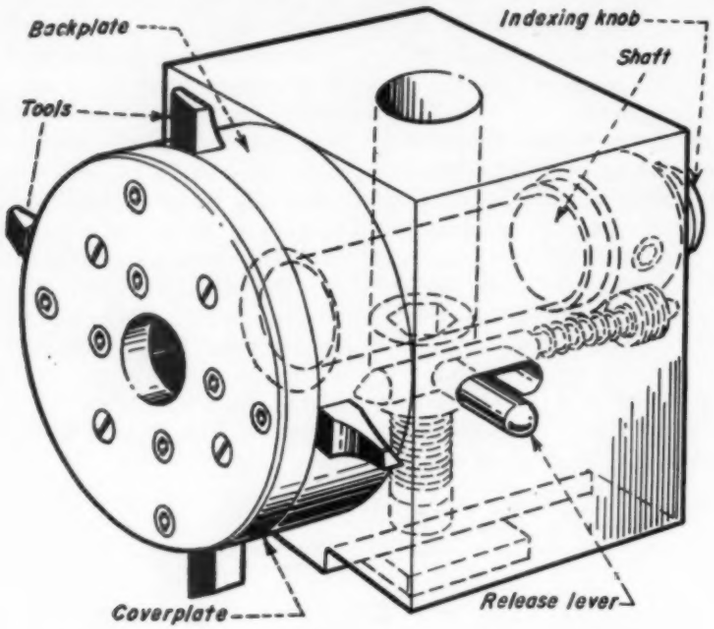
Templet-Indicator Setup Planes Brake Dies from Precut Sample

Form planing is done in our shop by mounting a templet on the crossrail and attaching a dial indicator, through an arm, to the saddle. With a rigid arm, the cutting is quite accurate.

Crossfeed is engaged to move the saddle with the tool and indicator horizontally, while vertical motion is controlled through hand feed. Keeping the dial indicator at the same reading with hand feed will duplicate the templet shape on the work.

The support for the dial indicator is as heavy and rigid as space allows, because this quality controls accuracy. If necessary, the templet is mounted on an arm attached to the crossrail to extend it to the outside of the machine, but the arm must be rigid.

Brake-die work and other large jobs are done in this manner. Both templet and indicator bracket are attached by clamps or bolts, whichever is more convenient. *Paul E. Wasser, Kankakee, Ill.*



Four-Way Tool-Holding Turret Cuts Engine-Lathe Time for Small Lots

We often have small lots of 25 to 200 pieces to be turned on a lathe. The lot size is too small to warrant tooling up an automatic machine, so we speeded production on an engine lathe by making a four-way toolholder that acts much like a turret. It allows four lathe tools to be interchanged with little effort and no change in setup.

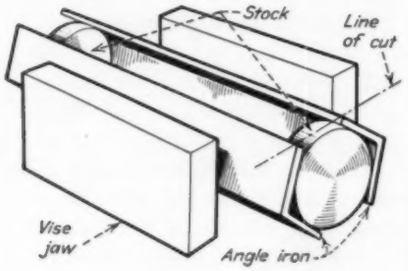
All parts can be machined from scrap stock. The small turret is made in two parts—a cover plate that carries eight clamping screws, and a backplate that has been machined out of solid stock with a shaft extension. The backplate is recessed in each quarter of its face to admit toolbits. The size of bits to be installed control the over-all size of the holder. The cover plate is screwed to the backplate.

Indexing is accomplished by pulling back on the release lever and twisting the indexing knob. The release lever is connected to a spring-loaded pin that slips into counterbored holes in the back face of the backplate. The holes are spaced to align the toolbits horizontally when they are in working position. The indexing knob is held to the end of the backplate shaft by a setscrew.

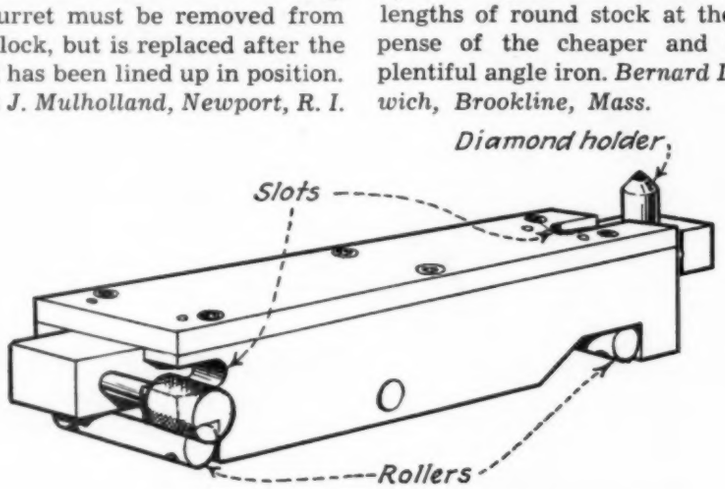
The toolholder is mounted on a lathe cross-slide by a large setscrew that slips through a vertical hole in the block. For mounting, the turret must be removed from the block, but is replaced after the block has been lined up in position. *Dana J. Mulholland, Newport, R. I.*

Angle Irons Clamp Stock in Saw

A number of thin sections of large-diameter round stock had to be power-sawed. When the stock was long no difficulty was experienced in clamping it in the saw vise, but toward the end of a length of stock the work was too short to clamp solidly in the vise jaws.



Using two angle irons as illustrated, the work was clamped firmly in place. The sawing operation cut through the angle iron as well as the solid stock. A finished section was clamped at the other end of the angle irons to square them up. The procedure saved short lengths of round stock at the expense of the cheaper and more plentiful angle iron. *Bernard Levowich, Brookline, Mass.*

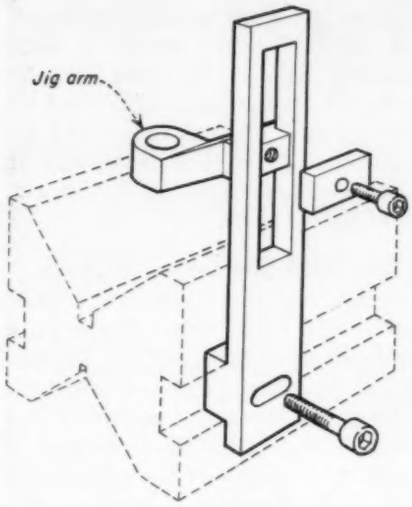


Sine Bar Dresses Measured Angles On Outside Grinding-Wheel Edges

Angles can be formed on a grinding wheel by sliding the shaft of this diamond-carrying dresser along its channel.

The dresser is set up like a sine bar, and can be bolted to an angle plate through a hole in its side. Two rollers screwed into recesses in the base provide blocking points. The top cover is fitted to the channel with recessed capscrews. A knurled handle provides a grip.

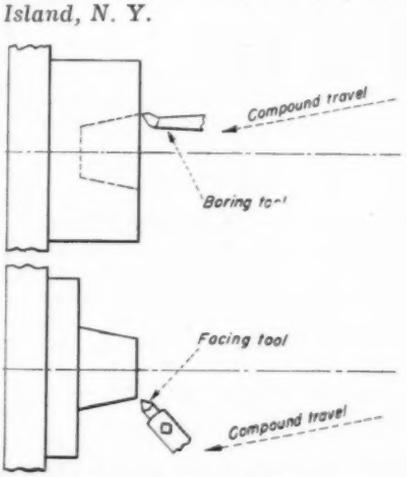
Slots in the top plate and the side of the channel allow clearance of the diamond holder and knob, while the unsupported length of shaft is kept at a minimum. *Philip Crain, Bronx, N. Y.*



Drill Jig Fits on V-Block

Standard V- blocks can be attached with this drill jig to allow production of accurate holes in round work. Held into the side slot of the block by a bolt, the jig is centered over the V.

The jig arm can be adjusted in two positions, which change the capacity of the assembly. Drill bushings of the proper size are mounted in the jig hole for both drilling and tapping. The accuracy of the work will be determined by the accuracy with which the jig is made. *Francis Spollen, Staten Island, N. Y.*



Duplicate Punch and Die Taper Cut by Backhand Boring System

Turning duplicate tapers on punch and die sets can be very tricky, but we use a setup that makes the job easy. It is simple enough that many toolmakers may have overlooked the idea.

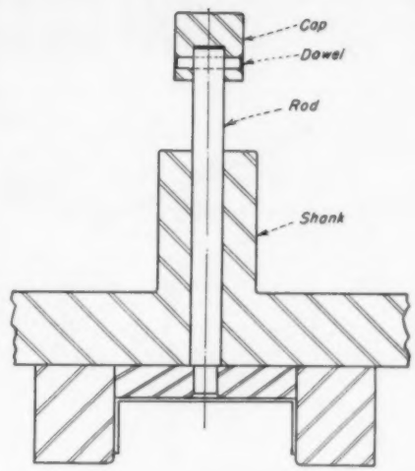
The compound slide is set at the required draft angle to the lathe centerline. Then a boring tool is mounted in the toolholder and the die is bored to size. This is done by running the lathe spindle backwards and crossing the tool to the back side of the lathe.

Then the die is replaced by the punch and a turning tool is clamped in the toolholder. The punch is turned in the conventional manner. In both cases feeding the tool was done by advancing the compound, while lateral adjustment was made with the cross-slide. *Gustave Remacle, Union, N.J.*

Capped Knockout Takes Die Shock

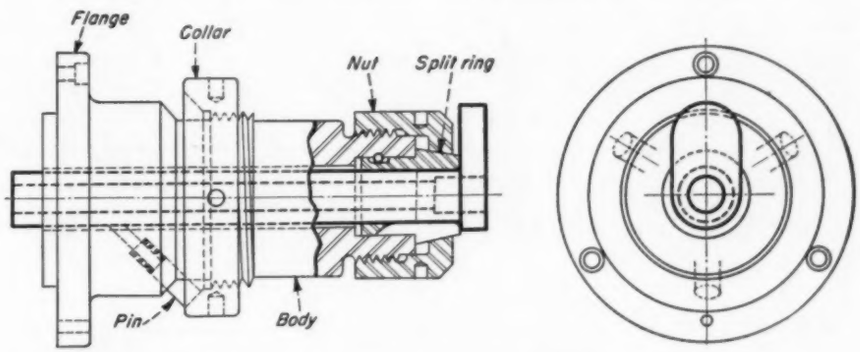
Many types of positive knockouts for drawing dies are complicated and expensive to make. Others are not rigid enough to be withstand the constant shocking. Frequent accidents are the result. The knockout illustrated is simple to make, easy to remove, and will withstand considerable abuse.

The cap of hardened tool steel



is bottom-drilled to press fit over the knockout rod. A pin hole is drilled through the end of the rod, and is reamed to receive a dowel. This secures the cap to the rod.

All the upstroke ram pressure is concentrated at the bottom of the cap hole. On the downstroke the bottom surface of the cap strikes the top of the die shank—taking the thrust of the knockout bar. *Roger Isetts, Kenosha, Wis.*



Split Collet and Beveled Pins Hold Lathe Work Fore and Aft

Chucking long, thin work in an engine lathe is not always easy, especially if the piece must be held tightly at both ends to line it up exactly with the centerline of the lathe. This split-collet fixture is useful in such cases.

The front end of the work is held in an ordinary split ring, forced against the work by a wedging action of a threaded nut. The end of the fixture body is threaded to take the nut.

The underside of the collar is beveled at about 45°, and three spring-loaded pins, fitted into holes in the body, rest against the beveled edge. These pins have beveled ends which contact the work inside the body behind the collar. The collar is knurled for tightening, and four small holes are drilled in its outside edge to take pins for final tightening.

Bolted to an engine-lathe faceplate, the fixture was used in one case for holding the work shown so the short section at the head end could be counterbored. *F. H. Scriber, Pawtucket, R. I.*

Side-Cutting Shaper Tool Clips Wire Lengths in Gaging Fixture

Limited production of short lengths of wire can be made fast and flexible by setting up the cut-off operation on a shaper.

A hardened tool-steel block is squared, drilled and reamed for a number of sizes of wire. A single large hole in the block takes the shank of a gaging plate, and a setscrew hole is drilled and tapped in the block at right angles to the shank hole.

The hardened block is ground on a surface grinder, preferably after the holes have been drilled. After long operation the hole edges may become dull, but the block can be either reversed or re-ground.

The gaging-plate shank is held in place by a socket-head setscrew, and can be adjusted to any convenient length. The plate itself can be made from flat stock. A side-cutting tool is clamped in the shaper's clapper box. This must be ground and aligned to present its cutting edge parallel to the face of the hardened block. *J. R. Paquin, Worcester, Mass.*

Lathe Work Remounted in Chuck

When three-jaw universal chucks have lost their original precision they are not completely useless, but it is difficult to re-chuck work in exactly the same position for a second cut. This means that a second turning will not be concentric with the first.

One way of avoiding this trouble is to scribe a deep line in the face of one of the chuck jaws. When new stock is chucked it is scribed longitudinally so a line on it meets with that on the jaw. Thereafter the work can be taken out of the chuck, inspected or worked on, and chucked again in exactly the same position relative to the jaws.

If the work cannot be scribed deeply at the head end, coloring material can be put on the part being turned. *Federico Strasser, Santiago de Chile.*

NOW... $25 for the best Practical Idea in each issue

(in addition to regular payment for all exclusive contributions published)

An extra payment of $25 will be made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

Payment—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of the issue. The winner will also be announced in these pages as soon thereafter as practicable.

Judges—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, will hereafter select the best Practical Idea. If at any time their votes result in tie, $25 will be paid to each and every co-winner. The decision of the readers will be final in each case.

Requirements—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product — in terms of its usefulness to them.

Who May Enter—Anyone may enter except employees of the McGraw-Hill Publishing Co., Inc., and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

How to Enter—Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42nd St., New York 18, N. Y.

53rd Selection—Donald P. Campbell's Page of Practical Ideas

NEWS OF METALWORKING

Record Peacetime Military Orders Split Among 13 Aircraft Concerns

WASHINGTON—New military orders placed by the Air Force and Navy are expected to put the aircraft industry into the black for the first time since the end of the war.

Record peacetime procurement pie of $1,998,800,000 was split among 13 major aircraft manufacturers. The biggest slice went to North American Aviation, Inc., of Inglewood, Calif., with Air Force orders for 451 swept-wing F-86 jet fighters; 266 T-28 training planes, and 51 four-jet B-45 bombers.

Others who garnered substantial orders:

Douglas Aircraft Co. of Santa Monica, Calif., with an Air Force order for 88 giant C-124 four-engine transports and a Navy commitment for 356 reciprocating engine AD-2 attack planes, and 28 F3D twin-engine jet night fighters.

Grumman Aircraft and Engineering Corp., Bethpage, Long Island, with an order for 317 of its better-than-600-mph. jet fighters (F9F); 38 twin-engine Albatross amphibians to be split between the Air Force and Navy for air-sea rescue work; and 23 AF-1 Navy piston-engine search planes.

Lockheed Aircraft Corp., Burbank, Calif., with an order for 457 latest model Shooting Star jet fighters (P-80C); 128 two-seater jet trainers modelled on the P-80, and 82 Navy P2V patrol bombers.

Other Orders

Boeing Airplane Co., Seattle and Wichita: 162 four-engine B-50 bombers, successors to Boeing B-29 as the standard Air Force heavy bomber.

Northrup Aviation Corp.: 30 giant Flying Wing eight-jet bombers (B-49).

Republic Aviation Corp., Farmingdale, Long Island: 409 Thunderjet fighters (P-84).

Curtiss-Wright Corp., Columbus, Ohio: 88 twin-jet fighters (F-87) for night fighting and photo-reconaissance. Originally designed as a four-jet plane the F-87 will go into production carrying only two-jet engines.

Fairchild Engine & Airplane Corp., Hagerstown, Md.: 107 twin-engine Packet transports (C-119).

McDonnell Aircraft Corp., St. Louis: 179 twin-jet Banshee Navy fighters (F2H).

Chance-Vought Division, United Aircraft Corp., Hartford, Conn.: 33 Pirate, Navy jet fighters (F6U) and 19 radically-designed tailless, twin-jet fighters with rocket auxiliary boost power (F7U).

Glenn L. Martin Co., Baltimore: 47 Maulers (AM-1) Navy attack planes powered by a piston engine.

Sikorsky Helicopter Division, United Aircraft Corp.: 37 helicopters for the Navy.

The Navy has 30 more aircraft still to place.

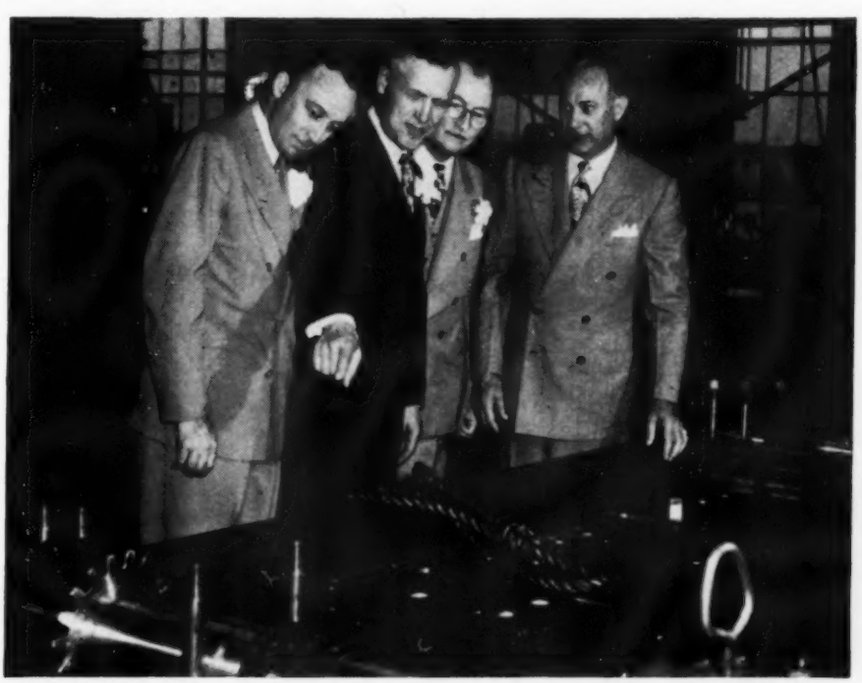
Among major aircraft manufacturers missing from the procurement list were Convair of San Diego and Fort Worth, Bell Aircraft of Buffalo, builder of the XS-1 first supersonic aircraft; and Ryan Aeronautical Co., San Diego.

Air Force Secretary W. Stuart Symington hinted that Convair's B-36 program, already cut from 100 to 95 of the giant six-engine, 10,000-mile bombers, would face additional cutbacks. Symington said the Air Force had decided to invest no additional funds in the B-36 program and added that any improvements in current models would be financed out of appropriations already made, thus reducing total number of planes manufactured.

$297 Million Held

WASHINGTON—With the fiscal 1949 funds made available by Defense Secretary Forrestal the services are buying 3,366 aircraft with 2,201 going to the Air Force and 1,165 to the Navy. Forrestal has temporarily blocked allocation of $297 million additional procurement funds authorized by Congress.

Final disposition of these funds is expected to be made after a presidential review of the aircraft procurement program and international situation in September.



LEADING INDUSTRIALISTS attended an open house program at E. W. Bliss Co. plant in Toledo, Ohio. Marshall M. Smith, president of Bliss (second from left), shows (left to right) Russ C. Gibson, of J. L. Clark Co., Rockford, Ill.; D. H. Kelly, president of Electric Auto Lite Co., Toledo; and William E. Paris, vice president and director of operations of Willys-Overland Motors, Inc., Toledo, the crown of a large Bliss press. Progress of Bliss' $1,250,000 plant-expansion program highlighted the tour by 150 executives from many fields

Export of Capital Goods, National Defense Discussed at MAPI Meeting

WASHINGTON—ERP will not hit its stride in capital goods orders until the first quarter of 1949.

There is nothing wrong with Britain that an increase of 10% in production won't cure.

Importation of capital goods into Latin American countries is of little use unless such factors as raw materials, transportation and trained manpower are favorable.

Industry should be permitted to take government contracts on the same basis as it would any commercial contract.

These were a few of the points made by speakers at the annual meeting of the Machinery & Allied Products Institute at The Mayflower June 10. William J. Kelly, institute president, presided at all sessions.

Britain's efforts to get more production per manhour were lauded by James Y. Scott, president Van Norman Co., who had just returned from a brief trip to England. He described a conference on production efficiency at which one British manufacturer told about the factory in England beating the record of the American plant. One of Britain's problems, he said, are the same as ours: to get labor to understand the job that industry must do and to do its part in that job.

Special Equipment Needed

Mr. Scott stressed that Britishers are becoming aware that "in-line" production does not mean sacrificing quality of product. It may help it instead. Very little U. S. heavy equipment can be exported to Britain, he said, because the British will not admit any machinery which can be made at home. There is a good market, however, for special equipment in England.

MAPI's report on technical stagnation in Britain, said Mr. Scott, is being studied closely over there. In their desire to get costs down and to capture export markets, the British will provide stiff competition for our industries.

Four Steps Cited

Four steps are necessary if better profits are to be stimulated, declared A. G. Bryant, president National Machine Tool Builders' Association and vice president Cleereman Machine Tool Co.:

1) Concerted action to correct taxation deterrents such as double taxation of corporate dividends, enforced excessive distribution of earnings, unsound regulations regarding depreciation, and suggested renewal of excess profits taxes.

2) Dropping by the government of renegotiation of contracts and recognizing in its place the importance of competitive bidding with the incentive of being allowed to retain earned profits.

3) Making clear the true facts about profits to labor, the public, stockholders and management.

4) Getting out from under the cloud that seems to have descended upon profits. "Without profit American industry could not have progressed to its present state, and without profit in the future we will suffer a decline not only in our earnings, but in the real wages paid to labor and in the living standard of all peoples."

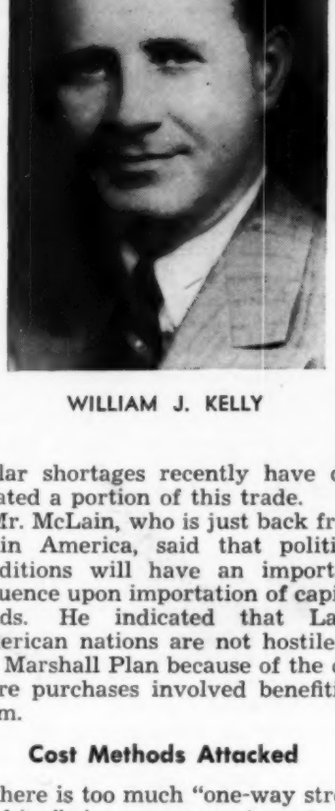
Denouncing renegotiation procedures in World War II and as proposed for the present defense program, Mr. Bryant made the point that government agencies should negotiate for war materiel at the lowest conceivable cost. But "there is no justification for the recapture of profits earned in a business, the products of which are used in peace as in war, and the price policies of which are recognizably competitive and in keeping with all reasonable business standards." He continued, "Renegotiation (during the war) encouraged inefficiency, put a premium upon delay and gave no real recognition to initiative, experience and performance."

Export Business Lost

Mr. Bryant stated that "it is difficult to see how the present defense needs can possibly place heavy demands upon the entire machine tool industry." He said that the industry had lost this year a large part of its normal export business, but this loss may be recouped when ECA really gets going months from now.

ECA programs will originate in the countries affected and will be carried out here without the use of priorities, declared Howard Bruce, ECA deputy administrator. Some capital goods will be ordered in the third quarter and more in the fourth, but sizable volume is not anticipated until next year.

One-third of all U. S. exports of capital goods in 1947 went to Latin America, according to Chester McLain, general counsel International Bank. The dollar total was eight times the 1938 figure and was 80% greater than in 1946. Reasons: 1) increased prices, 2) pent-up demand, and 3) accumulation of substantial dollar resources during the war. But dollar shortages recently have dissipated a portion of this trade.



WILLIAM J. KELLY

Mr. McLain, who is just back from Latin America, said that political conditions will have an important influence upon importation of capital goods. He indicated that Latin American nations are not hostile to the Marshall Plan because of the offshore purchases involved benefiting them.

Cost Methods Attacked

There is too much "one-way street thinking" in government cost accounting, reported C. A. Packard, vice president and comptroller Worthington Pump & Machinery Corp. and chairman MAPI accounting council subcommittee on contract cost principles. He denounced the current move to revive the government's so-called "green book" and to put into operation a set of cost accounting principles harmful to industry. He criticized the ruling that all selling costs would be disallowed except for performance of the specified government contract.

William Dermody Heads Carlton Machine Tool Co.

CINCINNATI—William A. Dermody has been elected president and general manager of the Carlton Machine Tool Co. Other officers are Frank Moran, vice president and treasurer; James V. Carlton, secretary; and Mary Katherine Carlton, assistant treasurer. Directors of the company consist of Mrs. Katherine G. Carlton, Mary Katherine Carlton, Frank Moran, William A. Dermody, and Fred W. McIntyre, Sr.

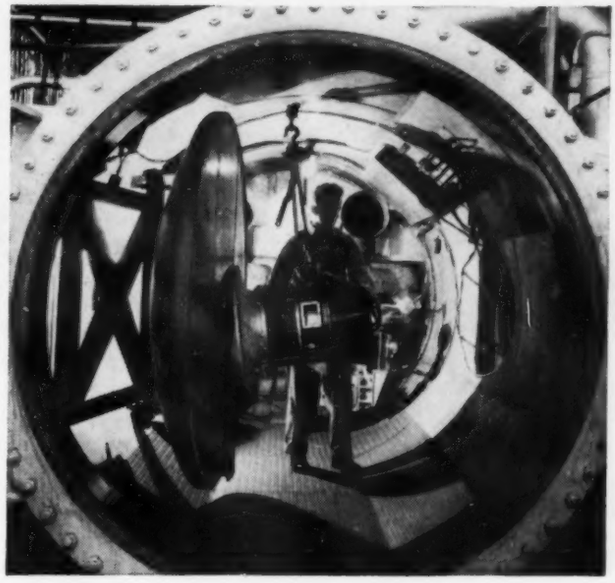
Mr. Dermody succeeds to the office held by Jack Carlton until his death recently. Mr. Carlton was for many years one of the most widely known men in the machine tool industry.

Detroit

EFFECT OF TOOL AND DIE STRIKE SEEN LIGHT ON NEW-MODEL TOOLING . . . STEEL SHORTAGE HITS OUTPUT OF PASSENGER CARS

Strike action in member shops of the Automotive Tool & Die Manufacturers Assn. at Detroit came after the two United Auto Workers Union locals involved took the flat position that any raise they obtained would have to be larger than anyone else's. Their position was that their craftsmen members were the highest paid in the auto industry, and hence should receive the largest advances.

In the face of the 11¢ General Motors and 13¢ Chrysler settlements, therefore, the locals demanded 15¢. When their walkout began they raised the demand to 20¢—a bargaining maneuver. The last offer of the Association was 11¢ at once and 3¢ additional a year from now on a 2-year contract. This offer was made despite the fact that on a cost-of-living formula basis (as used in G.M.) the craftsmen were not entitled to any raise whatsoever.



SCALE-MODEL jet engine compressor being installed at General Electric jet center will be laboratory tested for altitudes up to 70,000 feet

Work Schedules Down

The shutdown will not cast any shadow over new model tooling unless it goes on for a lengthy period of a few months. As has been previously reported, a large share of makeready for 1949 models is pretty well finished. No new programs of consequence were in the shops. Further, work schedules were down around 45 hours, leaving plenty of leeway, when resumption comes, for operations to go up to the 55 to 60 hour levels which are not unusual in tooling up periods.

Probably more effect will be created by the tool strike outside of Detroit than in it. A very large share of the work in the shops at this time has been for non-automotive outlets, including not only retooling jobs but also day-in-day-out replacement programs. Noncompletion of work of this sort could conceivably pinch a variety of customers.

Willys-Overland Motors, Inc., having shown two versions of its planned passenger car during each of the past two years, is casting about again for ideas and seems intent on coming up with still a third design. Some tooling for the new model is understood to have already been placed. The indication is that the new Willys (whose makeready will not be a large program, but rather a notable modification of some of the jeep tools and dies) may first show itself to the public late this year. That timing would jibe with the general expectation of a number of new models this fall, and it would also jibe with the possibility that jeep and jeep station wagon sales may begin to shake down from their present level.

Willys has distributed an ambitious and attractive booklet describing its forge facilities, available for contract work. This forge includes more than 192,000 sq. ft., capable of handling 80-million lb. of forgings yearly. There are 26 steam hammers ranging from 2,000-lb. through 12,000-lb. capacity, two open-frame blacksmith hammers, six hot forging presses up through 1,500-ton capacity, 12 upsetters, two forging rolls and a No. 2 bulldozer.

Purchasing agents are peering at the business picture rather dourly. The latest report of the Detroit Association, covering May, shows that only 7% of reporting members find general conditions better than in April, while 88% found them worse.

This dovetails with the buying pattern of the purchasers. Hand-to-mouth buying was reported by 14% in May, compared with 5% in April. One-month buying terms were reported by 15% (against 11%). No buying farther than six months ahead was reported. The effect of the tightened buying policy was reflected in the showing that 25% of those reporting had lower inventories than in April, while but 17% reported higher inventories.

Passenger car production surged into high ground after the end of the Chrysler strike, reaching about 104,000 units during the second June week. Thereafter it fell off noticeably for a fortnight as steel shortages closed General Motors fabricating and assembly divisions.

By the end of June manufacturing volume should be stabilized once more above the 100,000-a-week level. The one fly in the productive ointment after that will be the possibility of a breakdown in negotiations at Ford, where both the company and the U.A.W. went into sessions rather militantly during mid-July. But Detroit generally does not expect a Ford strike to occur.

Employment throughout Detroit and the state (aside from the G.M. layoffs of a week or ten days per plant) is holding steady. Reports from the Michigan labor department and the state unemployment Compensation Commission show negligible variation in payrolls during March, April, and May. June hiring was expected to give the totals a mild boost. The stabilized employment at nearly peak levels seems to be causing an increase in job shifting and the quit rate has also gone up.

Farm Equipment Demonstrated

Showing off its wares in mid-June, Dearborn Motors Corp., the marketing company for Ford tractors and Dearborn implements, held a demonstration at its experimental farm for 64 farm tools, 45 of them newly added to the line. The company now has 2,800 Dearborn equipment dealers, their recent selling rate being 9,000 Ford tractors and 40,000 Dearborn implements per month. During 1948 the company plans to market 100,000 tractors.

AGMA Elects Four Executive Committeemen . . .

LOUIS B. BOND

V.P. & G.M., Christiana Machine Co., Phila., Pa., a subsidiary of the Chas. Bond Company, and with that company since his graduation from Lehigh University

JOHN H. FLAGG

Pres., Watson Flagg Machine Co., Paterson, N. J.; with that company since graduation from Yale. Was AGMA president in 1942, previously V.P. and executive committeeman

S. L. CRAWSHAW

Mgr. Engrg. & Sales, Western Gear Wks., Seattle, and its subsidiary, Pacific Gear & Tool Wks., San Francisco, was chief engr. of Westinghouse (Nuttall), author many gear articles

PAUL A. MANGER

Chief Engr., Buffalo Div., Farrel-Birmingham Co., joined that company in 1905 as office boy, had time out for World War I, has been there since. Came to U. S. at age of 2

HOT SPRINGS, VA.—More than 400 people attended the 32nd Annual Meeting of the American Gear Manufacturers Association at the Homestead here June 6 to 9. In addition to electing the slate of officers and executive committeemen pictured above, the organization held a number of committee and general meetings and announced ratification of a new Constitution and By-Laws. AGMA Standard 243.01 on Materials —Cast Bronze Gear Blanks was approved. Membership has grown from 153 to 166 members, of which 95 are company, and five provisional company (in gear business less than five years), members.

The Fine-Pitch Gearing Committee has completed Part I of a fine-pitch worm-gear standard. This covers design aspects; Part II is planned to cover materials, lubricants, coefficients of friction and data affecting beam strength and durability.

Limits for involute splines (in the ASA standard) will be changed to meet gaging requirements, and a general pattern for gear-blank weights is to be developed. Work will be resumed on measurement of surface finish on gear teeth, even though equipment is not at present available for comparative measurement of this factor. Durability is undoubtedly affected by surface finish, so committeemen felt that work on the project might stimulate development of suitable instruments.

At the engineering forum June 8, S. L. Crawshaw acted as moderator for a group of six experts: A. H. Candee, Paul Manger, L. D. Martin, R. E. Rawling, F. Richardz and C. R. Staub. It is planned to repeat this quiz session at future meetings.

Discussion during the forum brought out that materials and heat treatment are more important than machining in gears. Uniform steel, uniform forging and uniform heat treatment are essential to consistent quality. For example, wear in forging dies may permit formation of a flash which will in turn cause distortion in heat treatment. Again, forging flow lines must be right, or strength and other characteristics are adversely affected.

R. E. Rawling described his plant's order procedure and exhibited forms used for the purpose. Among other elements, the form provides space for a description of how the gear will be used. Despite detail of specifications, a drawing is requested to support them; this has been found to eliminate many mistakes in interpretation. One discusser mentioned that his company maintains a card file of all estimates, thus saves time in estimating similar jobs.

Three Papers Presented

Three papers were presented during the meeting, "Statistics in the Gearing Industry," by D. T. MacCartney, AGMA statistician; "Factors Influencing the Quality of Ground Gears and Worms," by L. P. Tarasov, research engineer for Norton Company; and "The Problem of Noise in Marine Propulsion Gears," by George Wohlberg, supt., Wave Mechanics Labs., U. S. Naval Engrg. Experiment Station, Annapolis.

Mr. McCartney brought out that bookings of all gearing products were higher by 6.8% in 1947 than in 1946. Shipments were higher by 42.9% during 1947, however, which indicates substantial inroads into the industry's backlogs. Bookings in the first quarter of 1948 are up 17.4% over the same quarter of 1947, or 6.8% after adjustments for number of participants and average estimated price. Shipments were up 7.3% adjusted, 18.1% before adjustment.

Dr. Tarasov presented a very detailed paper which pointed out various types of faults in gears disclosed by grinding—including many not caused by the grinding itself. Most obvious defects are surface cracks, which are likely to cause premature failure under high stress. Another type is burn, which softens a surface layer and may set up stresses which cause cracking in service. Such defects may be caused in heat treating, grinding or machining, and may not necessarily be injurious.

Cracks may be detected readily by Magnafluxing or by etching in nitric acid at room temperature (15 sec. in 5% nitric). Both are non-destructive; stronger acid and longer exposure will bring out cracks more clearly but is destructive to the ground surface. Etching is, however, extremely useful to detect burn. Hot hydrochloric, or hot or cold sulphuric acid, are not recommended as etchants, for while they bring out cracks already there, they may also create new cracks in a tension-stressed surface.

Heat-treating cracks are fairly large and deep, while cracks formed during and after grinding are small, shallow, and definitely related to the

New Officers . . .

. . . Makes Connell Award

WALTER L. SCHNEIDER
V.P. & Director Sales, Falk Corp., Milwaukee, was elected president, AGMA, for the coming year. Began as apprentice at Falk in 1920, has been chief estimator, sales mgr.

F. W. WALKER
Exec. V.P., Phila. Gear Works, Inc., treasurer AGMA last year, was elected V.P. He was also chairman of the AGMA Genl. Commercial Cmtte. With Philly Gear 23 years

ROGER B. SALINGER
Pres., Mass. Gear & Tool Co., Woburn, Mass., and with that company 10 years. A member AGMA exec. cmtte. the past year, was elected Treasurer

Fabian-Bachrach

LOUIS B. MARTIN
Gear Engr., Eastman Kodak, received the Connell Award for "immeasurable contributions to the gearing industry's literature and knowledge, particularly in fine-pitch gearing"

grinding pattern. The latter type may be caused by grinding or by steel prestressed by faulty hardening. On flat surfaces, surface cracks are primarily perpendicular to the grinding marks. On curved surfaces, cracks may be perpendicular, but in many cases are parallel instead. Sometimes both types are present. Still another type of crack is spalling, which occurs primarily where contact between wheel and work is broad. In this case, cracks are shallow, but they turn parallel to the surface and join other cracks to cause flakes to spall out.

Burn may be readily detected by etching, even though all visible traces have been removed by subsequent operations. Dr. Tarasov explains types, causes and corrections in detail. His remedy for most of these faults is greater care and proper time, as well as proper equipment.

Mr. Wohlberg explained the Navy's interest in noise in gearing by saying its effects on health, efficiency, verbal communication of personnel, have now been superseded by sonic detection equipment, which may not only reveal an enemy ship but also may prevent such detection if self-noise is too high.

SPI Maps Plans For Annual Exposition In New York

ATLANTIC CITY, N. J.—In addition to an extensive series of technical papers, members of The Society of the Plastics Industry, at its annual meeting in the Ambassador Hotel here May 19 to 21, discussed plans for the Third National Plastics Exposition in Grand Central Palace, New York City, Sept. 27 to Oct. 1. More than 100 exhibitors are signed up, and attendance is expected to surpass the 30,000 of the previous Show.

Tell Berna, general manager of the NMTBA, addressed a session of plastics machinery manufacturers on "The Competition of Tomorrow." Mr. Berna pointed out that competition is essential to successful development of the industry, and explained the organization of the NMTBA and its work in developing machine-tool standards that are finding broad acceptance in other machinery industries. Plastics machinery makers, led by F. W. McIntyre, Sr., of Reed-Prentice Corp., plan to establish a similar organization.

NEW SPI OFFICERS . . . Seated, left: Board Chairman Neil O. Broderson (Rochester (N. Y.) Button Co.); President George H. Clark (Formica Insulation Co., Cincinnati). Standing, left: Treasurer J. J. B. Fulenwider (Hercules Powder Co., Wilmington, Del.); Secretary Norman Anderson (General Molded Products Corp, Des Plaines, Ill.); Vice-president Gordon Brown (Bakelite Corp., N.Y.C.). About 500 people attended the annual meeting at Atlantic City

J. M. Todd Nominated President of ASME at Semi-Annual Meeting

MILWAUKEE — James M. Todd, New Orleans consulting engineer, was nominated as the next president of the American Society of Mechanical Engineers during the semi-annual meeting, succeeding E. G. Bailey. Formal election will take place in the fall by letter ballot.

Other officers nominated are:

Regional vice presidents, Arthur Roberts, chief engineer, Lynchburg Foundry Co., Lynchburg, Va.; Forrest Nagler, chief mechanical engineer, Allis-Chalmers Mfg. Co., Milwaukee; Carl J. Eckhardt, professor of mechanical engineering and superintendent of utilities, University of Texas, Austin, and Albert R. Mumford, development engineer, Combustion Engineering Co., New York (renominated).

Engine Analyzer Developed

An airplane engine analyzer capable of diagnosing engine troubles while the plane is in flight has successfully met performance tests and is going into commercial production, James W. Wheeler, engine instrument engineer of the Sperry Gyroscope Co., Great Neck, N. Y., revealed in a paper during one of the technical sessions. The analyzer, functioning as a tool by which engine operation may at all times be monitored, will locate and diagnose these troubles quickly during flight, thus increasing flight utilization of the airplane and decreasing delay.

David North, Tulsa, Okla., stressed the steps made in overcoming the problems of ice on the surface and in various air ducts of airplanes. During the symposium on anti-icing, however, it was also brought out that advances in aircraft present new engineering problems and that meteorologists must increase their cooperation in forecasting icing areas. Mr. North presented data obtained during 50,000 flight miles over United States, Alaska and to Europe.

Lieut.-Comdr. O. A. Soli, Bureau of Aeronautics; R. L. Thoren, chief flight test engineer, Lockheed Aircraft Corp., and Thomas P. Koebel, supervising engineer of the Aeronautical Ice Research Laboratory atop Mt. Washington also spoke at the symposium.

The nation's engineers were urged by Dr. O. C. Simpson, associate director, chemical division, Argonne National Laboratory, Chicago, to turn their skills to the solution of many problems of atomic energy, declaring:

"It is highly essential that the number of technical people with atomic energy research know-how be greatly expanded if the United States is to retain its preeminent position in this field."

He also explained many problems now facing atomic researchers.

Engineering details of the country's largest water tunnel, to be built at Pennsylvania State College, State College, Pa., were disclosed by Prof. J. M. Robertson, in charge of the hydraulics laboratory, and Anthony J. Turchetti, former research assistant. The tunnel will be used by the Ordnance Research Laboratory at the college, principally for research on torpedo propellers. The circulating tunnel will be 97 ft. long and 31 ft. high. The test or working section will have an inside diameter of 48 ins. and will be 48 ft. long, large enough to permit testing models more than 8 ins. in diameter and 8 ft. long.

Rapid advance in the design of tanks for rocket power plants was foreseen by speakers during a technical session sponsored by the American Rocket Society, affiliated with the ASME.

Large-scale computers, now being built or in prospect, will be used for countless advances in science, engineering and industry, Dr. Harry D. Husky, head of machine development of the applied mathematics laboratories, National Bureau of Standards, reported. He said the new machines will become "an order of magnitude more powerful than previous machines, and will be worth "a quarter of a million people" working problems with pencil and paper.

Materials Handling Cited

The key to reduction of industry's overall production costs is in savings in materials handling, Frank M. Blum, manager of the crane sales division, Harnischfeger Corp., Milwaukee, asserted. "A recent survey in 120 factories revealed that materials handling costs, in the average plant, are actually about 36.3% of the overall production cost instead of the 25% that had been previously acknowledged by industry. Engineers are becoming more and more conscious of the cost of materials handling. This is probably because they well realize that they have squeezed the last drop of blood out of production efficiency in machine tools and machine-tool equipment. They are looking for other places for savings, and certainly the savings in materials handling are vast."

Locomotives Bought

WASHINGTON — The Indian government, through its Supply Council, has placed its largest single peacetime order for railway equipment. The order, for 200 broad-guage streamlined locomotives, is worth about $25 millon.

Half of the order will be filled by Baldwin Locomotive Works, the remainder will be split between two Canadian manufacturers—Montreal Locomotive Co., and Canadian Locomotive Companies.

The purchases are part of India's billion-dollar, seven-year program for development of rail transport.

Exports To Soviet Near High Peak

WASHINGTON—Last-minute scramble of American suppliers to get their exports to Rusisa in transit before the March 1 start of the drastic screening of all shipments to Eastern Europe, resulted in a $20,700,000 flow to the Soviet during the first quarter of the year. This was only about 10% under the high-level shipments during the same period last year.

Of the exports to Russia during the first quarter, more than 90% represented industrial machinery—electrical construction and conveying, and mining well and pumping equipment, and machine tools. This is a 20% increase in shipments of like material over the corresponding period last year.

N. P. LLOYD DIES

PHILADELPHIA—N. P. Lloyd, head of Lloyd & Arms, machine tool distributor, died on June 6. Mr. Lloyd was one of the best known men in the machine tool distributing field and for many years was active in the American Machine Tool Distributors' Association. He was special advisor during the war to the Chief of Ordnance, U. S. Army, and organized Machine Tool Panels in all the leading industrial centers to assist the Ordnance Department in expediting the tooling up for war production.

Correction

TIFFIN, Ohio—National Machinery Co. has announced completion of the world's largest mechanical forging press. This press, to be used for mass production of automobile crankshaft forgings, weighs 1,600,000 lb. It was erroneously stated in AMERICAN MACHINIST, June 3, p. 126, that this press weighs only 530 tons.

Names in the News

Ed Strieder

Henry Schlachter

Ed Strieder and **Henry Schlachter** have been appointed regional managers of the Cimcool Div., The Cincinnati Milling Machine Co., Cincinnati, Ohio. Mr. Strieder will manage the Eastern Region from the company offices in New York City, and Mr. Schlachter will manage the Central Region from the home office in Cincinnati.

W. K. Ginman has been named director of the new Detroit office of the Tocco Div., The Ohio Crankshaft Co., Cleveland, Ohio. The new setup includes engineering, sales and service facilities covering all phases of induction heating.

Robert L. Hanson has been appointed manager of the Allen-Bradley office in Pittsburgh, Pa.

Harold H. Martin and **Chris Wagner** have been appointed district sales representatives for Sapphire Products Div., Elgin National Watch Co., Aurora, Ill. Mr. Martin was appointed district representative for the state of Wisconsin while Mr. Wagner will represent Elgin in the Southern California area.

George A. Huggins has been appointed general manager of the Car Works plant of Pullman-Standard Car Mfg. Co.

J. Douglas Darby has been elected sales vice president of Carnegie-Illinois Steel Corp., Pittsburgh, Pa. Mr. Darby succeeds Thomas J. Hilliard.

Robert L. Hanson

J. Douglas Darby

Russell I. Haywood has been promoted to chief engineer of the Seybold Div., Harris-Seybold Co., Cleveland, Ohio. He succeeds **W. R. Spiller** who has been named assistant vice president in charge of engineering and research in the Cleveland plant.

Lt. Gen. Eugene Reybold, U. S. Army Engineering Corps (ret.) has been appointed vice president in charge of operations of the Lustron Corp., Columbus, Ohio.

James C. Hartley has been named vice president, general manager and director of Barium Steel and Forge, Inc., Canton, Ohio.

Fred O. Orthey

Fred O. Orthey has been appointed works manager of the Dumore Co., Racine, Wis.

Winfred C. Rodgers has retired as superintendent of the L. C. Smith & Corona plant in Syracuse, N. Y.

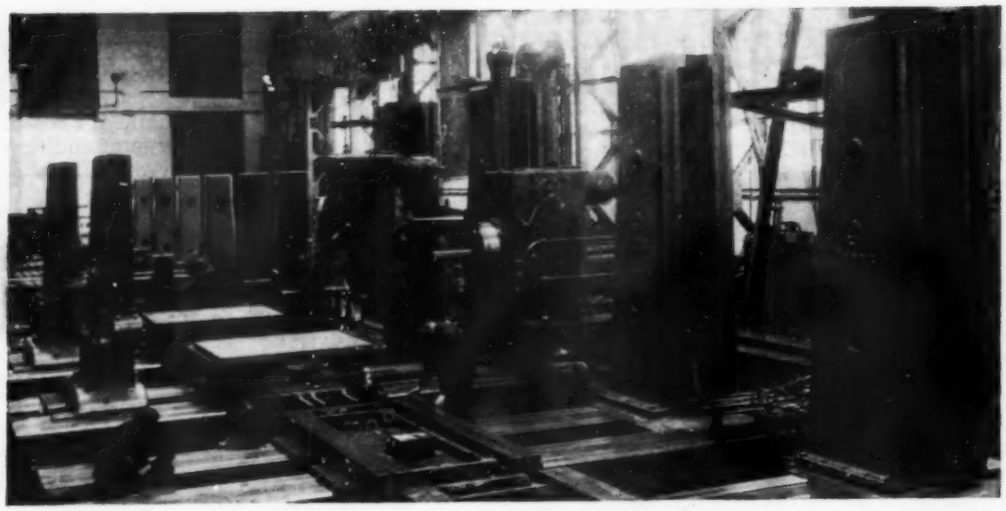
Russell C. Fancher has been appointed sales representative in the Detroit area for The U. S. Stoneware Co., Akron, Ohio.

OBITUARIES

Joseph P. Stapleton, 46, a partner in the Oatis Machinery Co., Cleveland, O., died June 1 suddenly. He was formerly employed by the National Supply Co.

Thomas H. Henkle, 65, retired sales manager for the E. G. Budd Co., died May 21 in Los Angeles, Calif.

Charles D. Lindley, owner of the Charles Lindley Machine Works, Olympia, Wash., died May 9 at the age of 63.



CZECHS ASSEMBLE big horizontal boring machines on production basis at the Skoda Pilsen Works. Skoda has Replaced Germany's Krupp Works as the leader of heavy engineering in central Europe

Czech Skoda Works Leads Central Europe

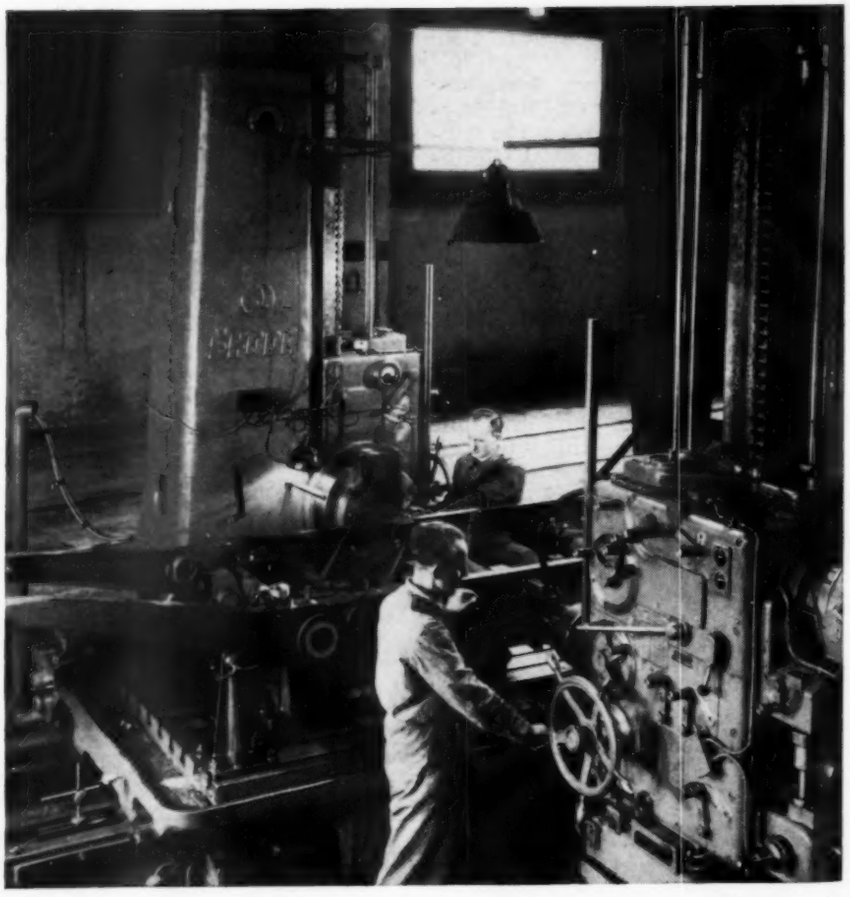
PRAGUE (McGraw-Hill World News)—Skoda Works, backbone of Czechoslovak economy, has replaced Krupp as largest heavy engineering works in central Europe. It now is concentrating on such products as turbines, diesel engines, machine tools and complete equipment for industrial plants. Its huge output is enabling the metalworking industry to hold first place in exports of Czech goods.

Skoda recently has furnished two sugar mills to Russia and one each to Yugoslavia, Finland, India, Uruguay, Iran, Morocco, Syria and the Netherlands. Large-scale refrigerating plants have been ordered by Turkey, Bulgaria, Iran, Afghanistan and Palestine. Railway tank trucks are going to Roumania and Turkey. Recently the two-hundredth locomotive was produced. The D500 miniature mechanical shovel (weighing 20 tons) is now being built; Skoda's largest shovel weighs 7350 tons. At its Komarno works, Skoda has just completed 10 welded-hull barges of 1000-ton capacity.

60% Going West

About 60% of Skoda's exports are going to the West. The heavy engineering works are at Pilsen, which was severely bombed by U. S. planes in '45. The factory in Prague makes diesel engines and machine tools. At Brno (Brunn) electric materials are produced. The factory at Adamov turns out railway brakes and tools. Boiler houses and machinery for sugar factories, breweries, alcohol distilleries and the chemical industry are built at Hradec Kralov. Electric motors and transformers are made at Doudlevce.

Firms affiliated with Skoda are the Bridge Building Co. at Hradec Kralov, the Hard Metal Tool Factory at Decin, and the Steel Works at Rotava. Previously part of Skoda but excluded from the present National Corporation set-up are the automobile factory at Mlada Boleslav, the Iron Works at Hradek and the Building Co. in Prague.

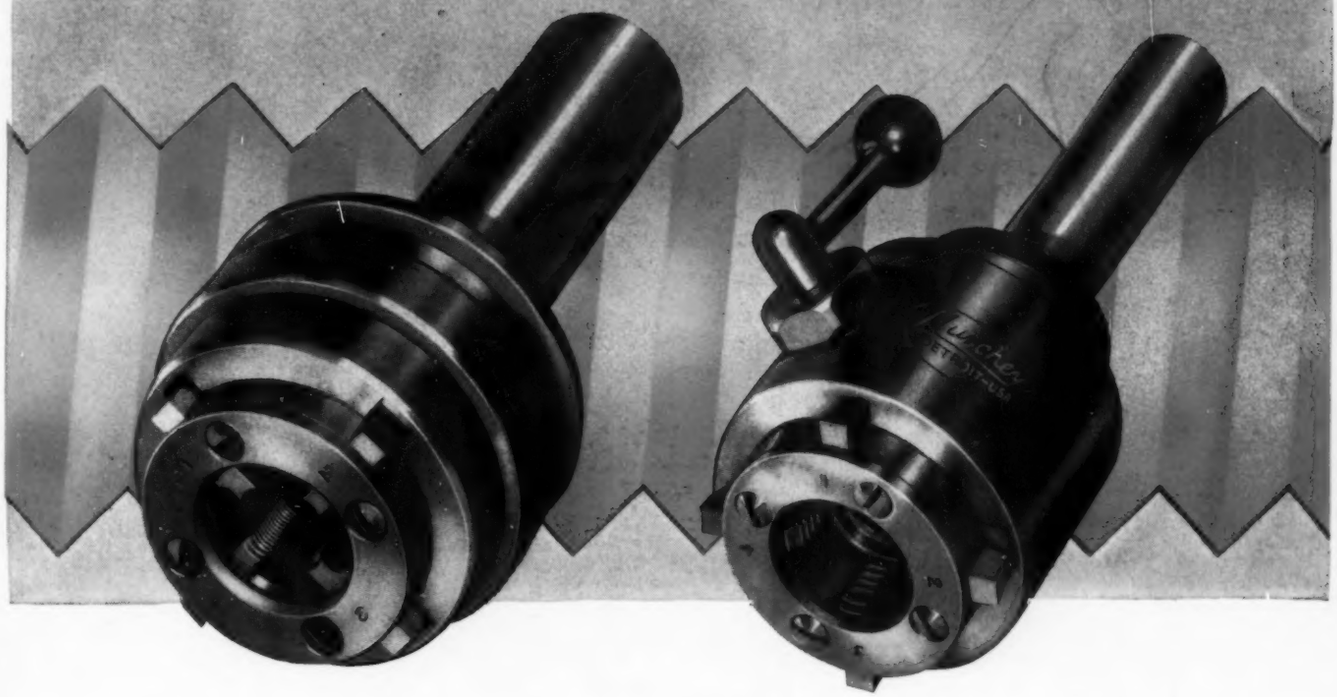


MODERN EQUIPMENT, made in its own plant, is used by the Skoda Pilsen Works to produce parts for more machines

Production per manhour at the Pilsen Works is claimed to be 25% higher than prewar. The works are operating one shift from 6 a.m. to 2 p.m. with two short breaks, six days a week. One-fourth of all employees are women.

Lower cost per thread

WITH IMPROVED RADIAL CHASER DIE HEADS



THESE MURCHEY STANDARD DIE HEADS CUT THREADS IN SIZES FROM NO. 6 TO 6" IN DIAMETER

Larger sizes are available. Both are equipped with quick change chasers and snap action trip.

The "ORB" is used on automatic screw machines, drill presses or other machines which rotate the tool.

The "OLB" is a pull-off type self-opening unit for use on turret lathes, hand screw machines or other machines on which the tool remains stationary. It is ideal for short length threads or threading close to a shoulder because of a new trip adjustment. Size adjustment is controlled by a single nut at the forward end of the shank.

2934

The case of handling

These tools and their simplicity of operation assure perfect threads at lowest cost. Ask for a demonstration in your own plant.

Lowest cost per thread . . .

WITH MURCHEY TOOLS

Manufacturers of collapsible taps, self-opening die heads (tangent and radial chaser types) and special threading tools

MURCHEY MACHINE & TOOL CO.

MURCHEY

SUBSIDIARY OF THE SHEFFIELD CORP.
DAYTON 1, OHIO, U.S.A.

MAKE SHORT WORK of jobs like these: templates, gages, test and cutting tools, parallels, machine parts, etc.

Why start from scratch on jobs like these?

STARRETT

PRECISION GROUND FLAT STOCK

Saves Men and Machines For More Profitable Work

How many hours do your men waste hunting up stock and grinding it to size for special tools and parts like these? A supply of STARRETT *Precision Ground* Flat Stock in the tool-crib will stop that waste of man and machine power. With STARRETT Precision Ground Flat Stock you simply lay out the part and go ahead. No lost time, no trouble, no extra expense. Your STARRETT Distributor carries a complete stock.

OIL AND WATER HARDENING TYPES. **High grade tool steel made to Starrett specifications 18-inch lengths, widths from ½ to 6 inches, thicknesses from 1/64" to 1" and more. Each piece individually wrapped and marked with size, type, heat treating instructions.**

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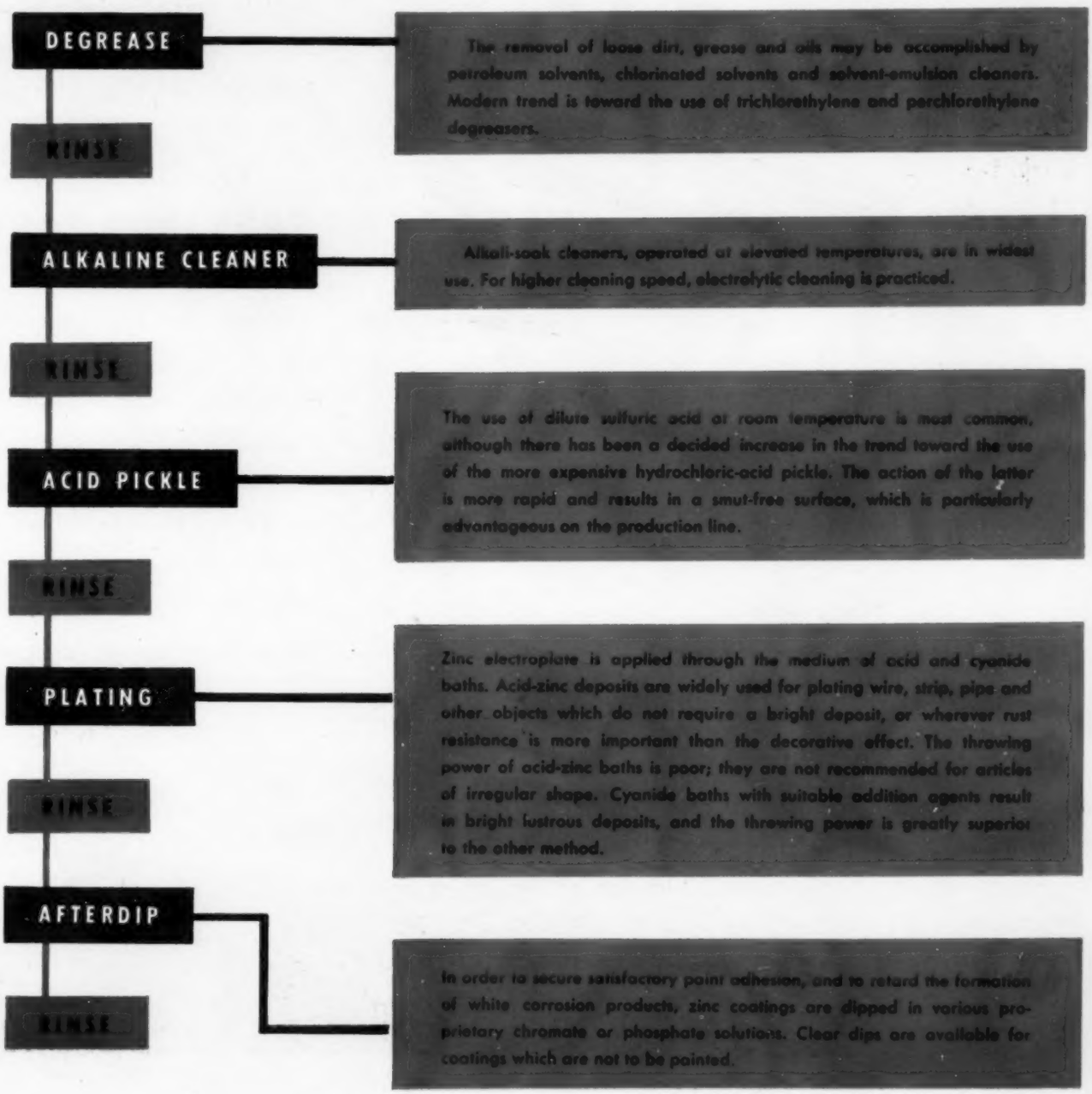
THE L. S. STARRETT CO. · *World's Greatest Toolmakers* · **ATHOL, MASSACHUSETTS, U.S.A.**

Process Sheet For Zinc Electroplating

BY GEORGE BLACK

Electrodeposited zinc is one of the most widely used protective finishes for small articles, because it is relatively simple to apply, economical in initial cost and application, decorative and highly corrosion resistant. Its high corrosion resistance has resulted in wide use for metal screening, steel strip, pipe couplings and wire. Insufficient tarnish resistance formerly provided a major drawback to the use of zinc plate for decorative consumer items. Now, recently developed bright dips and after-treatments, which maintain the brilliance of the plated coating, have given new impetus to its use in the decorative field.


DEGREASE
The removal of loose dirt, grease and oils may be accomplished by petroleum solvents, chlorinated solvents and solvent-emulsion cleaners. Modern trend is toward the use of trichlorethylene and perchlorethylene degreasers.
RINSE
ALKALINE CLEANER
Alkali-soak cleaners, operated at elevated temperatures, are in widest use. For higher cleaning speed, electrolytic cleaning is practiced.
RINSE
ACID PICKLE
The use of dilute sulfuric acid at room temperature is most common, although there has been a decided increase in the trend toward the use of the more expensive hydrochloric-acid pickle. The action of the latter is more rapid and results in a smut-free surface, which is particularly advantageous on the production line.
RINSE
PLATING
Zinc electroplate is applied through the medium of acid and cyanide baths. Acid-zinc deposits are widely used for plating wire, strip, pipe and other objects which do not require a bright deposit, or wherever rust resistance is more important than the decorative effect. The throwing power of acid-zinc baths is poor; they are not recommended for articles of irregular shape. Cyanide baths with suitable addition agents result in bright lustrous deposits, and the throwing power is greatly superior to the other method.
RINSE
AFTERDIP
In order to secure satisfactory paint adhesion, and to retard the formation of white corrosion products, zinc coatings are dipped in various proprietary chromate or phosphate solutions. Clear dips are available for coatings which are not to be painted.
RINSE

● Many small and medium size cast iron parts are now being surface broached at great advantage on Footburt Machines. With the single slide and duplex vertical machines built in four sizes with several broach lengths and the continuous type offered in four sizes, the proper

LATEST *Surface Broaching* METHODS ON CAST IRON PARTS

machine for most any capacity or production is available. Footburt engineers have a wide experience in development of tooling for speedy operation and accurate locating on all types of parts. Send blueprints for advice on the possibility of using Footburt machines on your work.

THE FOOTE-BURT COMPANY • Cleveland 8, O.
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FOOTBURT *Surface Broaching*

FOOTBURT PATENTED TOOTH FORM

Tempers for Aluminum Alloys—I

CAST and wrought aluminum materials are now made in so many different alloys and tempers that it is essential to use the correct nomenclature, in order to obtain a product suited to the end use. As far as alloys are concerned, there are two general groups: (1) the non-heat-treatable alloys and (2) the heat-treatable types.

Alloys are designated by prefixes such as 2S, 24S, 56S, etc. But temper designations (suffixes like—½H, —W, —T, and —RT) had grown up with the industry, and a few years ago were seen to be inadequate for future requirements. Hence, a rational and comprehensive system of temper designations was developed, but was applied only to all tempers of cast products and to some tempers of certain new wrought products. Now, the comprehensive system, after revision, has been adopted for all cast and wrought products furnished by Aluminum Company of America, Reynolds Metals Company, and Permanente Products Company.

Temper designations for the heat-treatable alloys are given in Part II. Similar information for the non-heat-treatable wrought alloys are given in the table on this page.

Despite changes in temper designations, the principle of the nomenclature system remains the same: namely, where a temper designation is required, it follows the alloy designation and is separated therefrom by a dash. The temper designation consists of a letter indicating the basic temper, and may be more specifically defined by the addition of one or more digits. No changes have been made in the temper designations of sand and permanent-mold cast products.

Temper Conversion Table for Non-Heat-Treatable Wrought Aluminum Products[1]

Alloys	Old Temper Designation	New Temper Designation: Strain Hardened Only	Strain Hardened and then Partial Annealed	Strain Hardened and then Stabilized
2S, 3S	—¼H	—H12	—H22	
	—½H	—H14	—H24	
	—¾H	—H16	—H26	
	—H	—H18	—H28	
	Extra-Hard	—H19		
4S, 52S, 56S[2]	—¼H			—H32
	—½H			—H34
	—¾H			—H36
	—H			—H38
	Extra-Hard			—H39

[1]Also available in —O and —F tempers.
[2]Alloys 4S, 52S, and 56S may also be obtained in —H1 and —H2 conditions.

EXPLANATORY NOTES

—F As Fabricated. Applies to products that acquire some temper qualities in shaping processes but are not subsequently thermally treated or intentionally strain hardened.

—O Annealed, Recrystallized. The softest temper of wrought alloy products.

—H Strain Hardened. Applies to products which have their strength increased by strain hardening with or without supplementary thermal treatments to produce partial softening. The —H is always followed by two or more digits. The first digit indicates the specific combination of basic operations and the following digit or digits the final degree of strain hardening.

Sub-Divisions of —H Temper:

—H1 *Strain Hardened Only.* The number following this designation indicates the degree of strain hardening. Thus, 2S-¼H (strain hardened only) becomes 2S-H12, and a temper intermediate between —¼H and —½H would be designated —H13.

—H2 *Strain Hardened and then Partial Annealed.* The number following this designation indicates the degree of strain hardening remaining after the product has been partial annealed. Thus, 2S-½H (strain hardened and partial annealed) becomes 2S-H24.

—H3 *Strain Hardened and then Stabilized.* The number following this designation indicates the degree of strain hardening remaining after the product has been strain hardened a specific amount and then stabilized. Thus, 52S-½H (strain hardened and stabilized) becomes 52S-H34.

—W The Unstable Condition Following Solution Heat-Treatment. This designation, because of natural aging, is specific only when the period of aging is indicated, e.g., 24S-W (½ hr.); 75S-W (2 mo.).

—T Treated to Produce Stable Tempers Other than —F, —O, or —H. This designation applies to products thermally treated to produce stable tempers with or without supplementary strain hardening. The —T followed by the numerals 2 to 19 inclusive designates one specific combination of basic operations. (Alcoa's 61S-T6, or Reynolds' R361-T6). Should some other variation of the same basic operations be applied to the same alloy, *resulting in different characteristics,* then other digits are added to the basic designation (61S-T61 or 61S-T62). It should be understood that a period of natural aging at room temperature may occur between or after the operations listed. Control of this period is exercised when it is metallurgically important.

Sub-Divisions of the —T Temper:

—T2 *Annealed.* (Cast products only.) This designation is applied to castings only, for such purposes as improving ductility and increasing dimensional stability (142-T21).

—T3 *Solution Heat-Treated and then Cold Worked.* This designation applies to those products where cold work is performed for the primary purpose of improving the strength (24S-RT becomes 24S-T36), and also applies to those products in which the effect of cold work, such as flattening or straightening, is recognized in applicable specifications (24S-T flat sheet heat-treated by Alcoa becomes 24S-T3).

—T4 *Solution Heat-Treated and Naturally Aged to a Substantially Stable Condition.* This designation applies when product is not cold worked after heat-treatment (24S-T sheet heat-treated by customer becomes 24S-T4), and also when applicable specifications do not recognize effect of cold work in flattening and straightening operations. (61S-W flat-sheet heat-treated by producer becomes 61S-T4).

—T5 *Artificially Aged Only.* Applies to products artificially aged without prior solution heat-treatment. The artificial aging of these products improves mechanical properties (53S-T5 extrusions) and dimensional stability (A132-T551 cast pistons).

—T6 *Solution Heat-Treated and then Artificially Aged.* This designation applies to products which are not cold worked after solution heat-treatment and in which the effect, if any, of flattening or straightening is not recognized in applicable specfications. (Whether flattened or not, 61S-T becomes 61S-T6 and 14S-T becomes 14S-T6).

—T7 *Solution Heat-Treated and then Stabilized.* This designation applies to products in which the temperature and time conditions for stabilizing are such that the alloy is carried beyond the point of maximum hardness, to control growth and/or residual stress (355-T71).

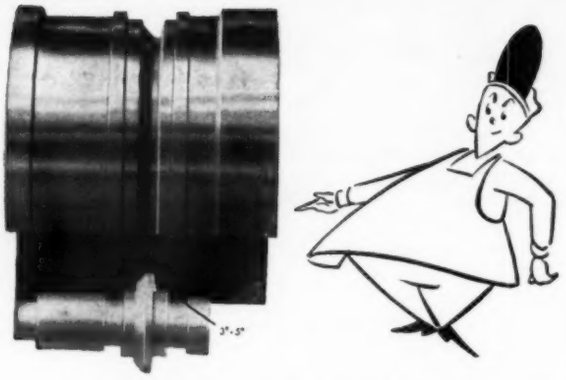
—T8 *Solution Heat-Treated, Cold Worked and then Artificially Aged.* This designation applies when the cold working is done for the purpose of improving strength (Alclad or Pure Clad 24S-T86), and also when the cold working effect of flattening or straightening is recognized in applicable specifications (Alclad or Pure Clad 24S-T81 flat sheet).

—T9 *Solution Heat-Treated, Artificially Aged, and then Cold Worked.* (The cast bearing formerly designated "XA750-T6 cold worked approximately 4%," becomes XA750-T91; Reynolds' R361-T91).

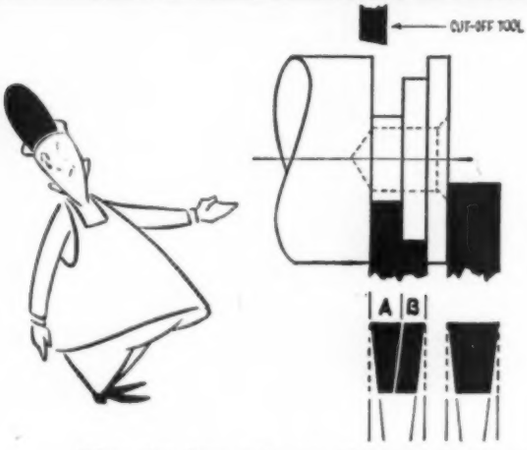
—T10 *Artificially Aged and then Cold Worked.* (The cast bearing formerly designated "705-T5 cold worked 4%," becomes 750-T101).

Stainless Sam Points Way To Longer Life for Form Tools

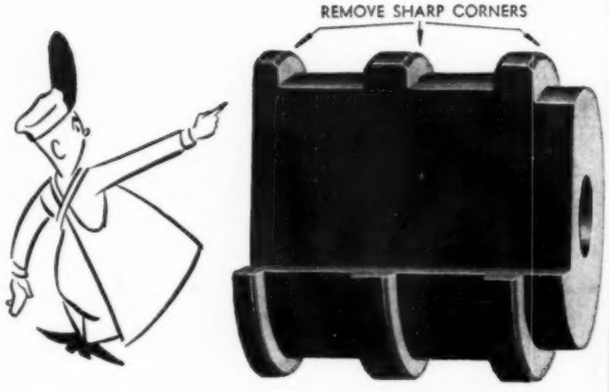
1 Free-machining grades of Stainless Steel can be formed at high rates, but form tools should be designed to compensate for their lack of side clearance. Stainless Sam points out where a conventional form tool will pick up and wear rapidly. Resharpening would require considerable grinding.



2 In contrast, this modified circular form tool with 3° to 5° relief-angle will yield longer tool life. It compensates for lack of side clearance, and balances the end thrust of spindle bearings. It is especially helpful when taking deep cuts—preventing galling and seizing of the metal.



3 When flat form tools are of simple design, side clearance can be achieved by another method—the split tool. The tool suggested here permits a number of resharpenings. Loss of size at "A" after grinding can be compensated for by moving the cut-off blade. Size at "B" will remain constant.



4 To permit higher cutting rates and reduce tool failure, roughing form tools should have all sharp corners ground with slight chamfers or radii. It makes possible the use of high cobalt, cast alloy tools or carbide inserts. A finish form tool, or shave tool operated with fine feeds may be used to finish the part to size.

If you are not using Stainless Steel bars or wire perhaps a product-analysis by your designers will show that you can improve your products with ARMCO Stainless Steel—often at little or *no increase in cost.*

You may find one or more parts where this strong, tough, rustless metal is not only justified but highly desirable. It may mean longer life or more efficient operation for your product.

We can give you prompt metallurgical assistance and quick delivery of ARMCO Stainless Steel bars, wire and angles. For up-to-the-minute information on machining ask for the new booklet, "Machining of Armco Stainless Steels." Write Armco Steel Corporation, 400 Curtis Street, Middletown, Ohio. Or call our nearest district office or ARMCO Distributor.

ARMCO
STAINLESS STEELS

ARMCO

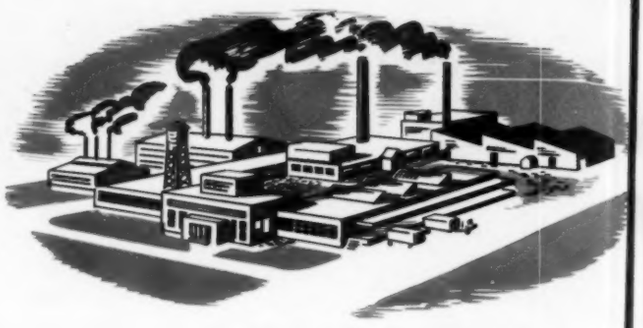
Tempers for Aluminum Alloys—II

TEMPER CONVERSION TABLE FOR HEAT-TREATABLE WROUGHT ALUMINUM PRODUCTS

ALLOY	Old Temper Designation	NEW TEMPER DESIGNATION											
		Sheet and Plate[1]				Extrusions[1]		Wire, Rod & Bar[1]	Drawn Tubing[1]		Forgings[2]	Rivets	
		Flat Sheet	Coiled Sheet	Plate	All Forms								
		Ht.-Tr. by Producer	Ht.-Tr. by Producer	Ht.-Tr. by Producer	Ht.-Tr. by Customer	Ht.-Tr. by Producer	Ht.-Tr. by Customer	Ht.-Tr. by Producer	Ht.-Tr. by Producer	Ht.-Tr. by Customer	Ht.-Tr. by Producer	Ht.-Tr. by Producer	Driven Rivets
11S	—W							—T4					
	—T3							—T3					
	—T8							—T8					
14S &	—W	—T3	—T4	—T4	—T4	—T4	—T42	—T4			—T4		
clad 14S[9]	—T	—T6	—T6	—T6	—T6	—T6	—T62	—T6			—T6		
	—T										—T61[4]		
	—T												—T3[5]
17S	—T							—T4				—T4	—T31[6]
	Any Temper												—T41[7]
A17S	—T											—T4	
18S	—T										—T61[4]		—T3[5]
	—T	—T3	—T4	—T4	—T4	—T4	—T42	—T4	—T3	—T4		—T4	—T31[6]
24S &	—RT	—T36		—T36				—T36					
clad 24S[9]	—T80		—T6		—T6								
	—T81	—T81											
	—T86	—T86		—T86									
25S	—T										—T6		
32S	—T										—T6		
A51S	—W										—T4		
	—T										—T6		
53S	—W					—T4	—T4				—T4	—T4	—T4
	Any Temper												—T41[7]
	—T					—T6	—T6				—T6	—T6	—T6
	—T5					—T5							
	—T61											—T61	—T61
	—W	—T4	—T4	—T4	—T4	—T4	—T4	—T4	—T4	—T4			
	—T	—T6	—T6	—T6	—T6	—T6	—T6	—T6	—T6	—T6		—T6	—T6
61S	—T5					—T5							
	—T62					—T62							
	—T81							—T81					
	—T					—T6	—T6						
63S	—T5					—T5	—T5						
75S &	—W	—W[8]	—W[8]	—W[8]	—W[8]	—W[8]	—W[8]						
clad 75S[9]	—T	—T6	—T6	—T6	—T6	—T6	—T6	—T6					
	—W	—T3	—T4	—T4	—T4[3]								
clad R301	—T	—T6	—T6	—T6	—T6								
R317	—T							—T4					
	—W										—T4	—T4	—T4
R353	—W												—T41[7]
	—T										—T6	—T6	—T6
	—T61											—T61	—T61
	—W	—T4	—T4	—T4	—T4	—T4	—T4	—T4	—T4	—T4			
	—T	—T6	—T6	—T6	—T6	—T6	—T6	—T6	—T6	—T6		—T6	—T6
	—T5					—T5							
R361	—T62					—T62	—T62						
	—T81							—T81					
	—T7							—T91					

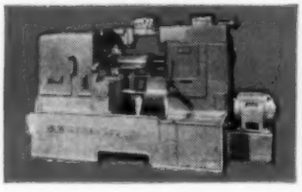
[1]Products listed are also available in —O and —F tempers.
[2]Forgings are also available in —F temper.
[3]Reynolds plate heat-treated by customer is designated —T42.
[4]Boiling water quench.
[5]Driven cold after full natural aging.
[6]Driven cold immediately after solution heat-treatment, or when refrigerated to defer natural aging.
[7]Driven hot, at the solution heat-treating temperature.
[8]To be specific, the time of natural aging must be stated, for example, 75S-W (2 hr.), 75S-W (2 mo.).
[9]Available only in the form of Sheet and Plate.

Where business is busiest...



Where cost reduction history is made....

Look for New Britain Automatics



Visitors to the modern New Britain plant often remark that we seem to leave no step untaken to make the finest machines it is possible to turn out. This is perfectly true. New Britain automatics are not built down to a price, but up to a high standard in the belief that the least expensive machine actually is the one that will turn out the most pieces per dollar for the longest time.

In our 800,000 square feet of modern manufacturing space are many advanced production machines and techniques at work in the manufacture of the 25 different New Britain models. Here our engineers and those of other leading American concerns are teaming up to produce better, lower cost machining for the future. Yet you will find skilled "old timers" painstakingly hand scraping ways and topflight assembly men testing and running-in each machine before tooling. Practical tooling is applied by engineers of long experience in making metal cutting a cost cutting operation.

You'll find the same spirit at work when your New Britain automatics are set up and running on your floor. We consider no transaction complete until the customer has the maximum accuracy and production of which his New Britain automatics are capable.

THE NEW BRITAIN MACHINE CO. NB

NEW BRITAIN

Automatics

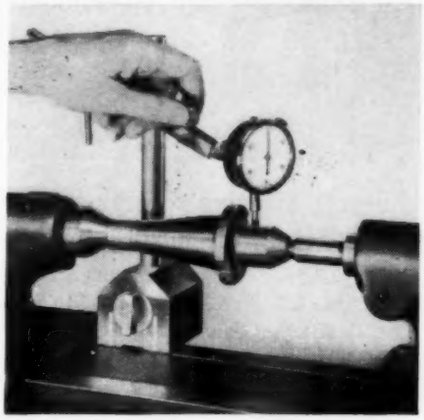
THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN-GRIDLEY MACHINE DIVISION
NEW BRITAIN, CONNECTICUT

7481B1

Would you like to see some examples of how New Britains pay off on the job? Send for the New Britain portfolio of "Cost Histories" which gets right down to cases on specific jobs. No charge, no obligation, of course.

Shop Equipment News

Brown & Sharpe Adds Small Tools And Permanent-Magnet Type Chucks



Brown & Sharpe Mfg. Co., Providence 1, R. I., announces additions to their line of small tools. Dial-holding rods with fine adjustments, illustrated, are offered in two sizes: the 0.375-in. diameter rod for dial-test indicators No. 730, 733, 744 and 744A, and the 0.738-in. diameter rod for dial-test indicators No. 731 and 731A. The former is priced at $7.50, and latter, at $12.50.

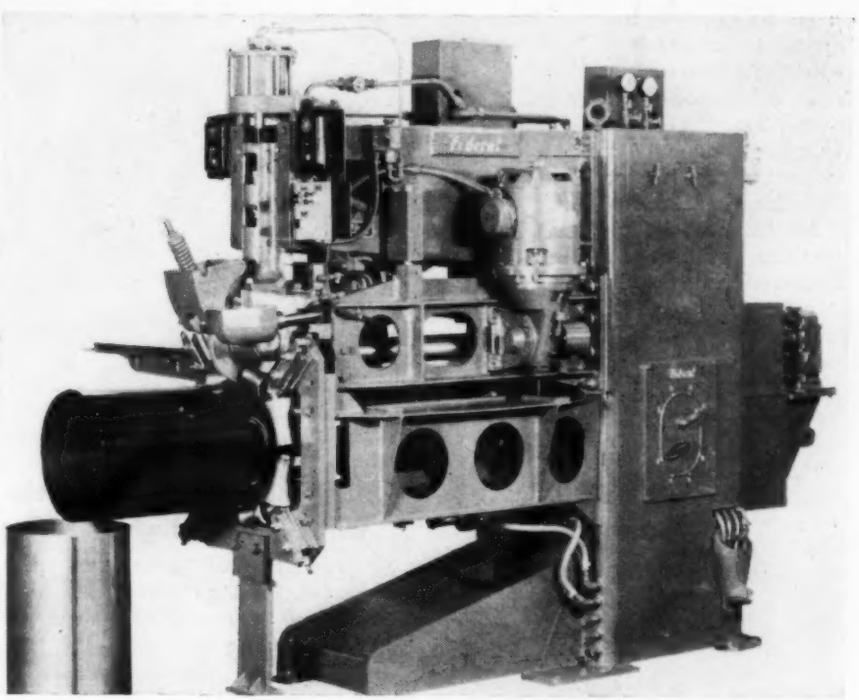
Also offered is the No. 226 ball attachment which snaps on anvil or spindle end of a micrometer caliper. Attachment can be used on all Brown & Sharpe micrometer calipers with conventional anvils and spindles except ½-in. micrometer calipers and the heavy types.

A center and small-hole attachment set, No. 573, converts a 6-in. or 150-mm. vernier caliper into a direct-reading divider. The small-hole points, used with a 6-in. or 150-mm. vernier caliper, make possible measurements between holes and recesses too small to receive the jaws of the vernier caliper. Points have two sizes of measuring surfaces with semi-circular cross sections. The smaller size has a 0.025-in. radius, the larger, a 0.050-in. radius.

A dial-test indicator, No. 743, features fine adjustment and a magnetic base. Turning the adjusting nut brings indicator point to exact setting desired. Range of dial attachment is 0.030 in. by thousandths of an inch.

Also offered by Brown & Sharpe is a permanent-magnet chuck, No. 408. The 4x8-in. working surface is suited particularly for use on small surface-grinding machines, bench grinders, and for bench work. Featured are the absence of wires and auxiliary generators, and freedom from heating. Chuck is suited for both wet and dry grinding, and is priced at $115.

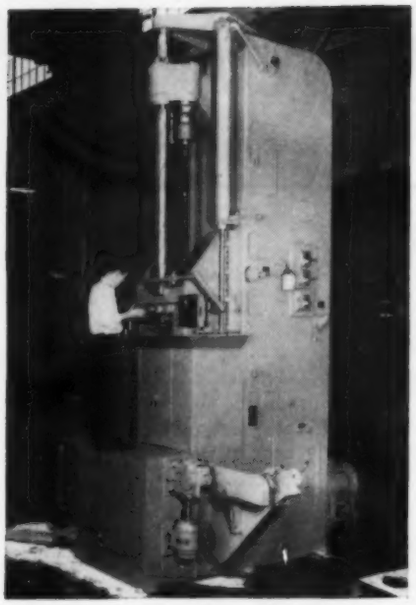
A rectangular model, two-line magnetic chuck, No. 412, and two rotary-model magnetic chucks, No. 5R, and 7R, are also offered. The No. 5R will hold work from ¾ to 5 in. in diameter for grinding on cylindrical grinding machines, tool and disk grinders, and also on polishing machines and for light cuts on small lathes. The No. 7R holds work from 1-3/16 to 7 in. in diameter.



Cylinder-Forming Seam Welder Makes to 1500 Pieces per Hr.

An automatic cylinder-forming seam welder is built by The Federal Machine and Welder Co., Warren, Ohio. A forming feature is incorporated in several sizes of the machine. Equipment will process 26- to 16-gage mild-steel cylinders ranging from 11¼ in. in diameter and 14 in. long to 22 in. in diameter, and 37½ in. long. Welder operates at production rates of 600 to 1500 per hr., depending on the length and material thickness of the cylinders.

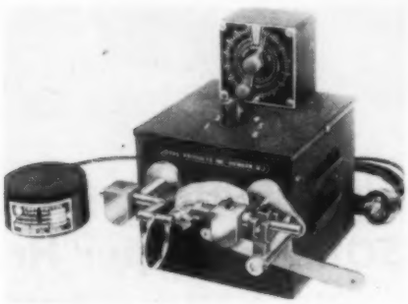
Machine can be supplied with either manual or automatic feed. Sheet stock is moved into the forming rolls of the welder and automatically welded and ejected onto a conveyor or onto a mechanical-handling system.



Vertical Broaching Machine Is Hydraulic, Pull-Up Type

A vertical pull-up internal hydraulic broaching machine is built by The American Broach & Machine Co., Ann Arbor, Mich. Machine has an over-all height of 16 ft. 10 in., a gross weight of over 17 tons, a normal-operating capacity of 30 tons, and a broaching stroke of 60 in.

Machine was designed to broach involute splines in gear blanks. Featured is the helix lead and nut bar for driving the broaches during the pulling stroke. The lower guide not only raises the broaches up to the pull heads but also continues up providing the large broaches with additional alignment during the stroke. A chip conveyor is provided for removing excess chips that accumulate in the coolant reservoir. Machine is pushbutton controlled.



Production-Soldering Machine Offered for Small Products

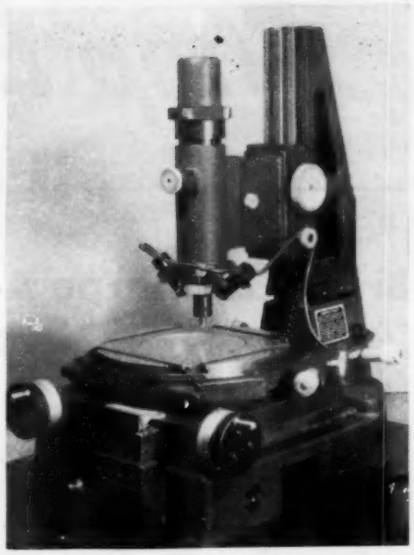
A production soldering machine for small hard- and soft-soldering jobs is announced by Joyal Products, Inc., 12 Grafton Ave., Newark, N. J. Machine can also be used to anneal and harden small parts. Interchangeable electrodes are specially designed for each job. The operation of electrodes is spring-action controlled so that when electrode arms are closed, work is held firmly for soldering and cooling.

The machine can be used either vertically or horizontally. An automatic cut-off timer regulates soldering time. Heat control with six adjustments enables the user to determine correct heat. Dials set a uniform soldering time, heat, and holding pressure on the electrodes, regardless of how long foot is held on the foot switch. The soldering machine is portable, 10x12½x7 in., and operates on 110 v. ac.

Drilling, Reaming, in One Stroke With Severance High-Speed Tool

Severance Tool Industries Inc., Saginaw, Mich., introduces high-speed drill-reamers offered in five standard sizes: 3/16-, ¼-, ⅜-, ½-, and 9/16-in. diameters. Tools are said to accomplish both drilling and reaming in one continuous stroke.

Drill-reamers are said to drill through materials of any thickness up to that equalling their diameter. An allowance is made for grinding the drill point a number of times. Tools are best suited for short, through holes, where it is possible to complete the drilling function before the reamer section begins to finish. Drill-reamers having longer-than-standard pilot drills are furnished to order for thicker materials. Solid carbide tools can be obtained when required. Reamer teeth have good shearing qualities.



Gaertner Spotting Attachment Allows Precision-Layout Work

The Gaertner Scientific Corp., 1201 Wrightwood Ave., Chicago 14, Ill., has developed the M2001SA2 spotting attachment, which is interchangeable with the standard optical system of the Gaertner Toolmaker Microscope. Attachment is used for laying out drill jigs, templets, and similar work requiring precision accuracy.

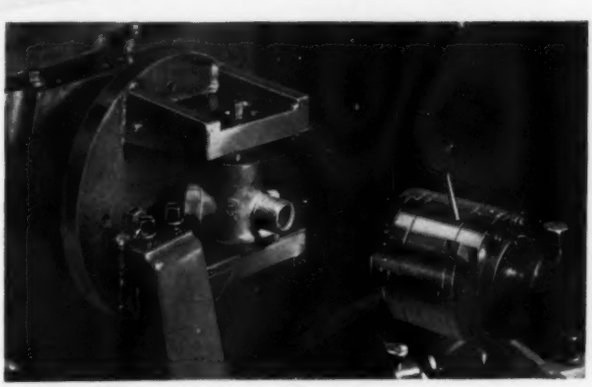
Attachment consists of a microscope of 25X magnification with facilities for mounting and spinning a tool. The spotting tool is located on the optical axis, permitting the object on the stage to be marked at the exact point viewed by the observer.

ELECTRIC TRACTOR, offered to meet moderate industrial-haulage requirements, is made by Mercury Mfg. Co., Chicago 9, Ill. Listed as Model A-560-5, tractor is 70x34 in., and has a light-running speed of 6.5 mph. The standard power source is a low-type, 36-v. battery of 300-amp. hr. capacity. Normal drawbar pull rating of the tractor is 200 lb.

FAMOUS MANUFACTURER SAYS . . .

"VERY SATISFIED WITH PERFORMANCE"..

• Aiding in the program to rebuild European railroads, a famous manufacturer turns out thousands of angle cock bodies for air brake equipment, using a battery of Lodge & Shipley ACME Turret Lathes. Turning, facing and threading operations are done at a high rate, obtaining output and accuracy which are "very satisfactory." Above and at right are illustrated typical chucking and machining views of this job.



• Lodge & Shipley ACME Turret Lathe owners consistently praise the operating ease and simplicity of these fine lathes, cite production records to prove the point. Investigate the profit possibilities of ACME Turret Lathes. Call in Lodge & Shipley Engineers or write for catalogs showing complete line of Ram-Type, Way Type and Saddle Type Lathes.

THE **Lodge & Shipley** COMPANY

MACHINE TOOL DIVISION • 3055 COLERAIN
SPECIAL PRODUCTS DIVISION • 800 EVANS ST.
CINCINNATI 25, OHIO

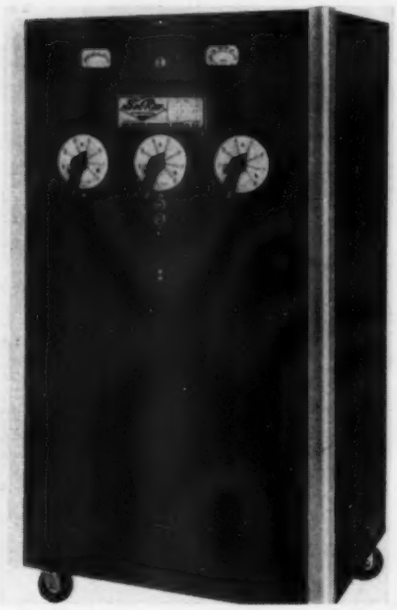
ELECTRIC-DRILL KIT, the Hi-Power Model 77, is made by Portable Electric Tools, Inc., 255 W. 79th St., Chicago 20, Ill. Kit consists of a ¼-in. portable electric drill and 10 high-speed drills in a steel, hinged-cover container. Drills fit in a drill rack that is part of the holder bracket for the drill

Turret-Lathe Boring-Bar Holder Takes 8 Different Bar Sizes

A boring-bar holder for use on the square toolpost on turret lathes is offered by Rex Mfg. Co., 837 St. James Ave., Springfield 4, Mass. Split adapters allow eight different sizes of bars to be used in one holder. The cam-acting barrel holds bar on center and parallel with the axis of the work. A grip of 4 in. reduces chatter and vibrations.

Sperry Supersonic Reflectoscope Inspects Welds in Ferrous Metals

Sperry Products, Inc., 1505 Willow Ave., Hoboken, N. J., introduces a supersonic reflectoscope for inspecting welds in ferrous and light metals for lack of bond, inclusions or voids. Known as the angle-beam transmission, the testing technique employs high-frequency sound waves. The sound beam enters into the welded part at an angle. The searching unit can be placed on the smooth parent metal adjacent to the weld, or even at some distance from it. Voids or inclusions reflect part of the sound beam back to the searching unit where it is amplified to provide a vertical deflection on an oscilloscope screen.



DC. POWER SOURCE for requirements up to 5000 amp. with varying voltages from 1 to 9 v., is offered by Bart-Messing Corp., 45 Morgan Ave., Brooklyn 6, N. Y. Unit is particularly suited for chromium, bright-nickel and acid-copper plating as well as electro-cleaning and electro-polishing. A continuous-plating control permits changing tap-switch positions without plating interruption. Selenium stacks are rated at 15,500 sq. in. of rectifying area

Manual Lincolnweld Equipment For Semi-Automatic Welding

The Lincoln Electric Co., Cleveland 1, Ohio, introduces the Manual Lincolnweld, for semi-automatic welding, which provides the necessary welding current and auxiliary power plus the automatic wire-feed mechanism and controls. Welder was designed for hidden-arc deep-flux welding employing high-current densities. Equipment is flexible and maneuverable and is said to produce smooth, penetrating, spatter-free welds.

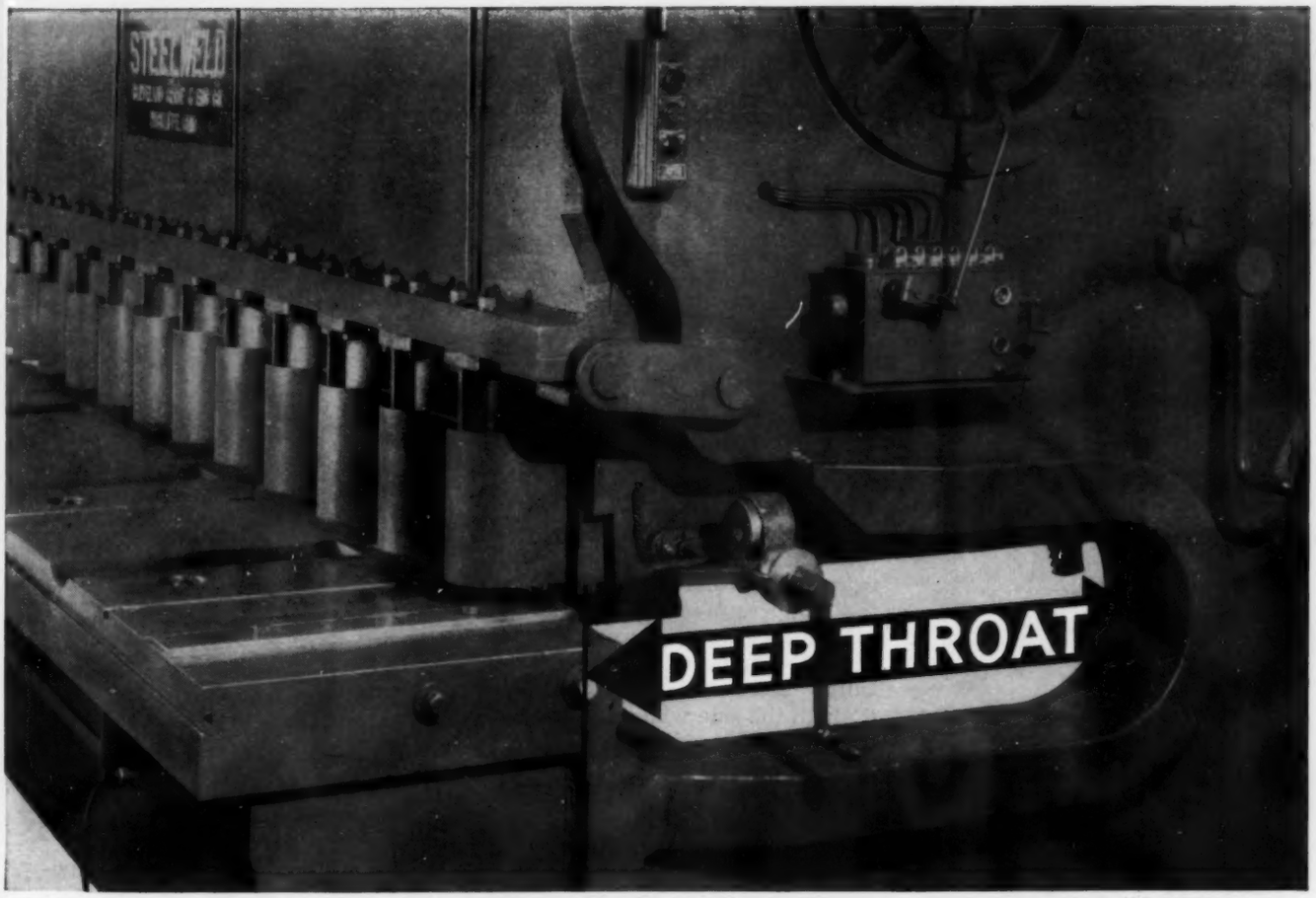
The basic element of the unit is a standard 600-amp. welder which can be used for straight manual welding as well as semi-automatic welding. The wire reel, feed mechanism, drive motor, and voltage controls, are contained in a compact unit. A cone-shaped welding gun attaches to a special cable. Welding gun holds 3½ lb. of flux.

Equipment uses a 5/64-in. dia. electrode wire which is automatically fed to the work through the flux that is deposited from the gun. A constant-arc voltage is maintained by automatic controls independently of height of gun above work.

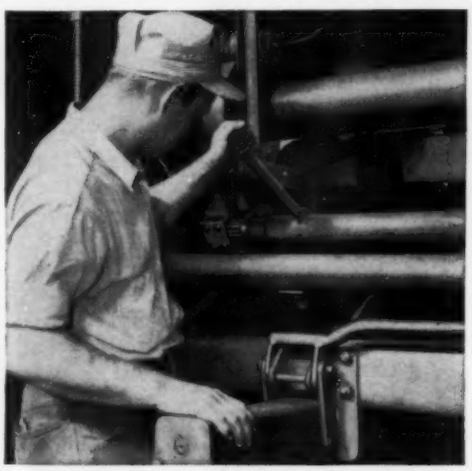
Automatic Indexing Machine For Drilling, Counterboring

W. K. Millholland Machinery Co., Indianapolis 5, Ind., offers the No. 3 vertical automatic-indexing machine for high-production machining. Machine performs a variety of operations such as drilling, counterboring, reaming, and milling. Horizontal side heads can also be used for additional operations.

Machine illustrated is equipped with a No. 3 Millholland automatic cam-feed unit with a 5-hp. motor. The 15-spindle multiple head is mounted on guide bars and equipped with a bushing plate arranged to register on the fixture at each index. A six-station table is shown although 3-, 4-, 6-, 8-, and 12-station tables can be furnished. Machine is arranged for an automatic continuous cycle, or intermittent operation by pushbutton control. One piece is completed at each index, giving a production of 500 pieces per hr. gross. Operator only loads and unloads the machine.



WIDE SHEETS EASILY SLIT



Steelweld Shears are built for thicknesses of 12 gauge to 1¼ inch and for lengths of 6 to 18 feet.

Throat depths of 18, 24 and 36 inches make it easy to slit wide sheets on Steelweld Pivoted-Blade Shears. Twenty-four inches is the standard throat depth for all but the smallest machines (series 100 is 18 inches). Thirty-six inch throats can be provided as a special feature for many of the larger size machines.

With such deep throats it is possible to slit plates of 36" to 72" wide down the middle for any length.

It is a simple matter to adjust the blade for slitting. The easily-reached slitting adjustment shaft is turned by a spanner wrench as illustrated. When adjustment has been completed a locking devise holds it securely in position.

Steelweld Shears are loaded with exclusive features that make operation easier and speed production. There are no other shears like them.

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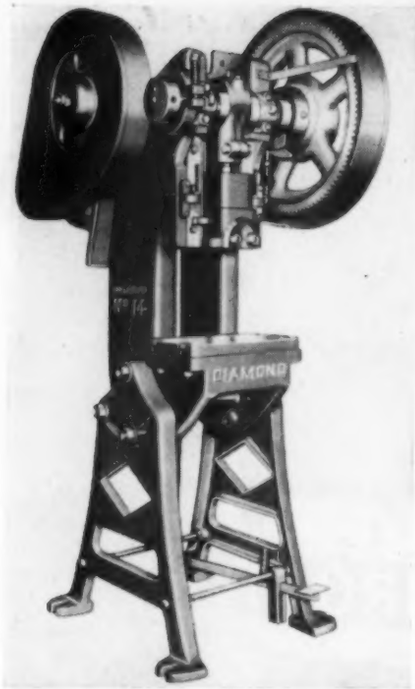
CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

1412 EAST 283rd ST. WICKLIFFE, OHIO

STEELWELD PIVOTED BLADE SHEARS



14-Ton Open-Back Geared Press Has 65 Strokes per Min. Max.

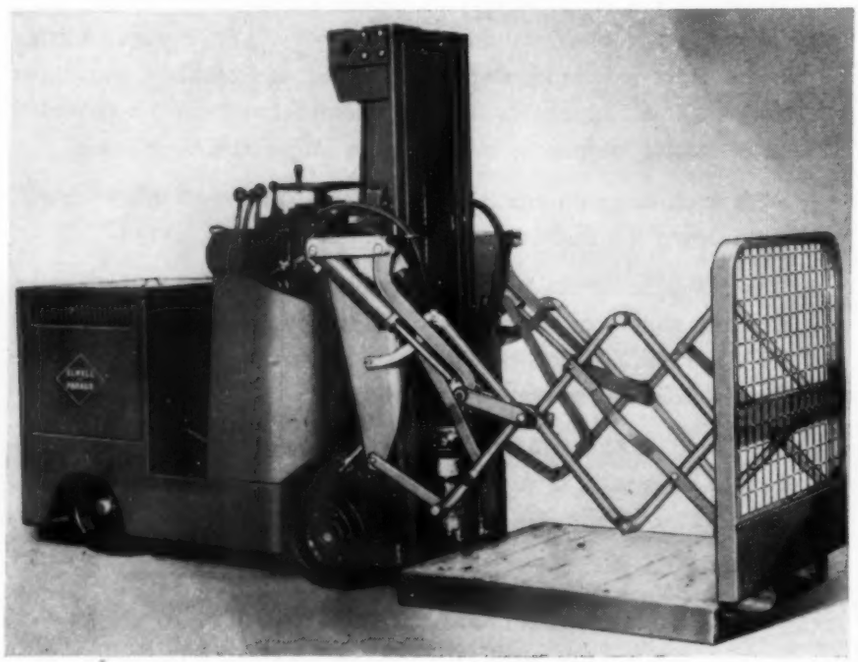
Diamond Machine Tool Co., 3429 E. Olympic Blvd., Los Angeles 23, Calif., introduces the 14-ton open-back inclinable geared press. Press offers 65 strokes per min. maximum, a 2-in. standard length of stroke and a bed area of 8x15 in. Press has a non-repeat single-trip mechanism.

The geared press in this small size is recommended for use when delivery of rated tonnage over a longer length of ram travel is desired, for operations using drawing dies, and forming dies, and in blanking operations where a large amount of shear is required. It is also recommended when using dial-index type of feeds.

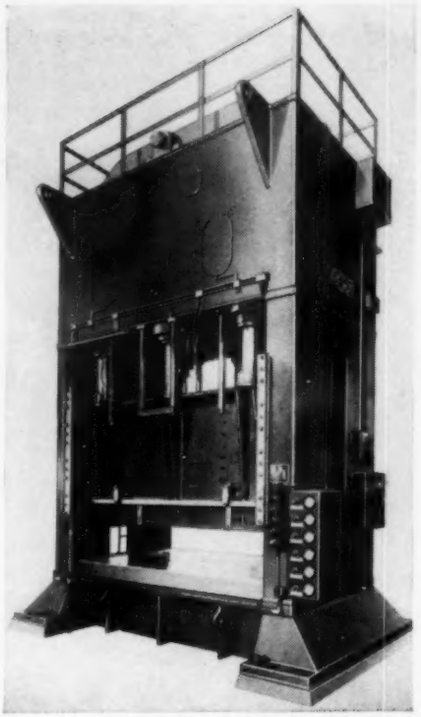
Ajax Hultgren Salt-Bath Furnace For Heat-Treating of Long Work

The Ajax Electric Co., Philadelphia, Pa., offers a new design of the Ajax Hultgren electric salt-bath furnace for heat treating in the temperature range of 300 to 2400 F., permitting work, regardless of length, to be hung vertically. Electrodes are inserted through the side walls and are completely immersed in the bath.

Furnace has three pairs of closely spaced vertical electrodes, cascaded for ease of restarting. Electrodynamic circulation assures uniform bath temperature, regardless of the depth of the bath or the number of pairs of electrodes used. The vertical loading is said to assure control over distortion.



POWER-TRUCK PALLET RETRIEVER, made by The Elwell-Parker Electric Co., Cleveland, Ohio, is attachable to the forward end of a truck. A load-handling or stabilizing mechanism consists of two hydraulically actuated pantograph-type rams which terminate in a screen frame that remains in fixed position with respect to the load. Rams are self-adjusing to fit and follow the contour and vertical or lateral motion of the load, while the truck with the pallet backs away and withdraws the pallet from beneath the load



Double-Action Deep-Drawing Press For Ferrous, Non-Ferrous Metals

A line of double-action deep-drawing presses for ferrous and non-ferrous metals is built by Verson Allsteel Press Co., 1355 E. 93rd St., Chicago 19, Ill. Listed as the Type MH presses, line is designed to combine the high-productive capacity of a mechanical-drawing press with the adjustable blankholder features found in a hydraulic press.

Featured is adjustment of pressure by valves and direct-reading gages at any pressure point on the blankholder. Blankholder is self-adjusting for any thickness of stock and automatically compensates for minor variations in stock thickness. Press cycle is automatic and push-button controlled.

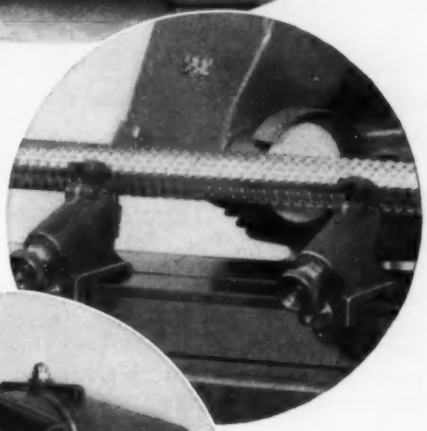
ARCMETER, for drawing and checking radii as small as 20 in., is offered by The Arcmeter Co., 2016 Sixth St., Rockford, Ill. Listed as Model B, arcmeter has a range of radii from 20 in. to infinity. Any radius in this range can be determined by moving the indicator knob, which is attached to a movable cam. A true arc can be determined by direct reading on the graduated scale. Model is 16 in. long by 3 1/8 in. wide and produces a 15-in. arc

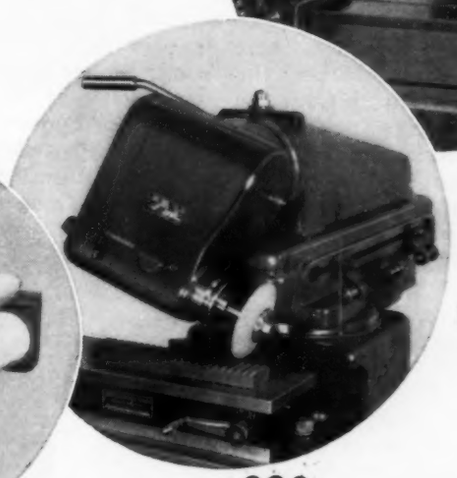
REJUVENATE YOUR BROACHES

TO ORIGINAL CONDITION

(Quick Delivery)

MODEL **FS3**
FOR
FLAT BROACHES





MODEL
RG1
FOR ROUND
BROACHES

MODEL **CS3**
A "UNIVERSAL" SHARPENER FOR
BOTH FLAT AND ROUND BROACHES

HOW TO PICK THE BEST BROACH SHARPENER FOR YOUR NEEDS

If you have only "round" broaches (cylindrical, spline, etc.) up to	You need this Sharpener
36 in. long	RG1-36
72 in. long	RG1-72
84 in. long	RG1-84
If you have only "flat" broaches (surface broaching)	FS3-36
If you have both flat and round broaches up to 72 in. long	CS3-72
84 in. long	CS3-84

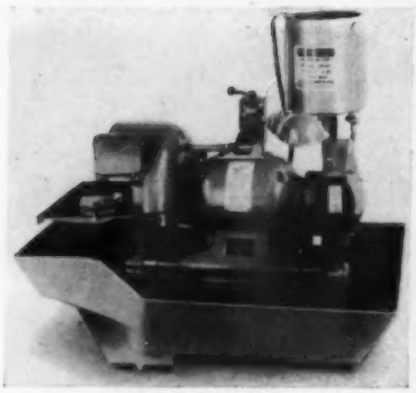
Ask for complete information by model number

---- with one of these Broach Sharpeners by

PIONEERS OF H.S.S. BROACHING

COLONIAL BROACH CO. DETROIT 13

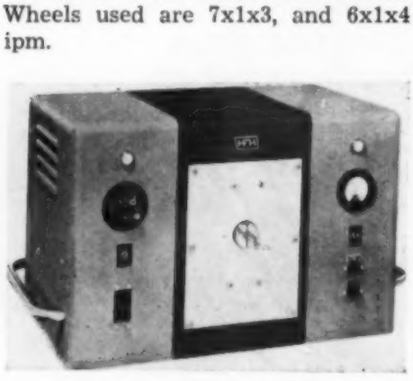
BEST BY TEST



Carbide, High-Speed-Steel Grinder Sends Coolant Through Wheel Body

Scheer Grinder Co., Collingswood, N. J., introduces the No. 2 off-hand grinder for grinding carbide and high-speed steels. Featured is the method of handling the coolant. Grinder includes a coolant tank, settling basin and pump section. The coolant is directed through the wheel body so that it is presented to the point of grinding contact from the interior of the wheel.

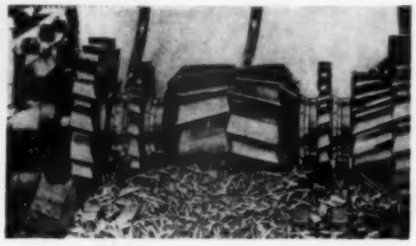
The coolant is controlled by a stop cock so that the wheels can be slightly moist for extremely delicate work, or full flooded by coolant for extremely fast cutting with no heat. Machine has both straight and cup wheels mounted on the same motor shaft and running in sealed bearings. Wheels used are of porous type either silicon carbide or aluminum oxide. A Foraminoid structure, which means that pores or holes are interconnected, is preferable so that coolant reaches entire wheel face. Wheels used are 7x1x3, and 6x1x4 ipm.



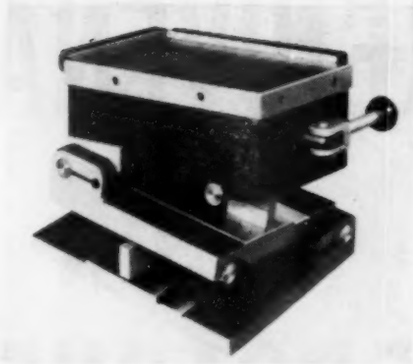
Generator for Induction Heating Is Designed for Production Work

A generator for induction heating on a production basis, is offered by The High-Frequency Heating Co., 143 Glen Park Ave., Gary, Ind. Known as the HFH-1.2A-L electronic-power generator, it heats any metal, magnetic or not, by induction. Copper and brass can be heated to desired degrees with a single-turn work coil.

High-frequency power is generated by a single-ended Colpitts oscillator. Water cooling for work coil is provided for high efficiency energy transfer. Power output is 1200 w.; frequency, 400 kc.

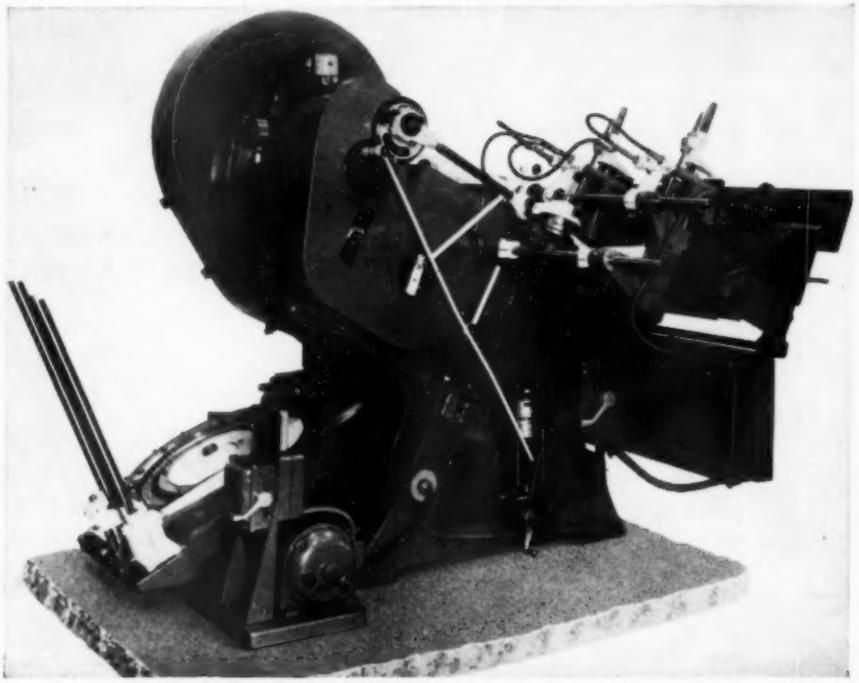


EUCO MICROMETRIC expanding milling spacers for gang and straddle milling are offered by George Scherr Co. Inc., 200 Lafayette St., New York 12, N. Y. Spacers are hardened and ground throughout, and are heat-treated to a Brinell of 590. Milling cutters in any desired combination can be assembled to an accuracy of 0.0005 in. Spacers consist of an outer sleeve moving telescopically on a fine thread and an inner sleeve keyed to the arbor. Outer sleeve is graduated like a micrometer in half thousandths of an inch markings



Magna-Sine with Magnetic Chuck For Precision Angular Set-ups

The Magna-Sine, made by Robbins Engineering Co., 318 Midland Ave., Detroit 3, Mich., is now offered with a permanent-magnet chuck. The Magna-Sine with the electric-magnet chuck is used for precision angular set-ups on operations such as inspection and grinding. Angles are set up by the sine-bar method using standard gage blocks. Used for either wet or dry grinding, device is built in models for single angles only, and models for both single and compound angles. Both models are available in two sizes. A handle controls amount of magnetic power.



AUTOMATIC STRIP-FEED PRESS for medium- and high-speed production, is introduced by Lima-Hamilton Corp., and built by the Hooven, Owens, Rentschler Co. division at Hamilton, Ohio. Designed for the can-making industry, press is made for either single or double dies, or multiple-die work with special slides. Listed as the Hamilton-Kruse Model No. 301, press operates at speeds to 225 strokes per min. and can be arranged for higher speeds. Press has a 25-ton capacity. Over-all floor space is 73 x 94 in.

CAN YOU BEAT IT?

10 SECONDS to cut 2 1/2" Electric Cast Steel

ATKINS "Curled Chip" MILLING SAWS

To be sure milling saw performance like this — reported by one Atkins user — is outstanding, even for an Atkins. But it does show why it will pay you to take a long, careful look at your own cutting operations.

It's easy to see why the Atkins "Curled-Chip" Method of metal cutting so often results in sensational reductions in cutting costs. Where the conventional angular tooth must push against a vertical face, the inward-curving Atkins "Curled-Chip" Tooth gets *under* the chip and *lifts* it in a continuous clockspring-like coil. Result: less tooth-dulling heat — faster cutting speeds — heavier feeds — cleaner, truer cuts that need less re-machining.

To find out just what this can mean to you, check with your distributor today. Ask him to have an Atkins Cutting Engineer arrange a demonstration on any work you choose.

ATKINS "CURLED-CHIP" SEGMENTAL SAW

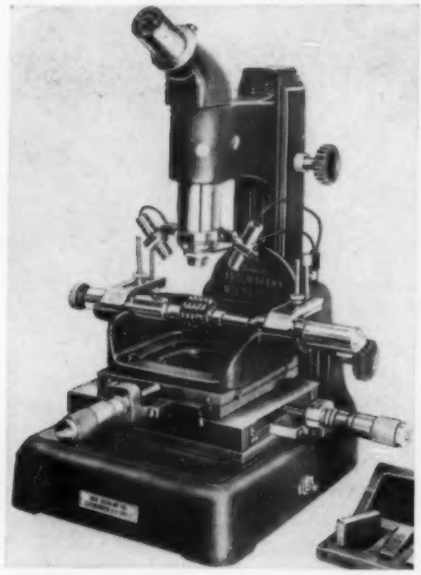
Engineered to increase cutting under the toughest demands of heavy-duty sawing machines. "Curled-Chip" teeth in segments permit consistently narrower cutting width. Worn-out teeth can be quickly replaced without discarding the saw disc.

ATKINS "Silver Steel" SAWS

E. C. ATKINS AND COMPANY • *Home Office and Factory:* 402 S. Illinois Street, Indianapolis 9, Indiana
Branch Factory: Portland, Oregon • *Branch Offices:* Atlanta • Chicago • New Orleans • New York • San Francisco

AAA TRADE MARK ATKINS "ATKINS ALWAYS AHEAD"

MAKERS OF BETTER SAWS FOR EVERY CUTTING JOB



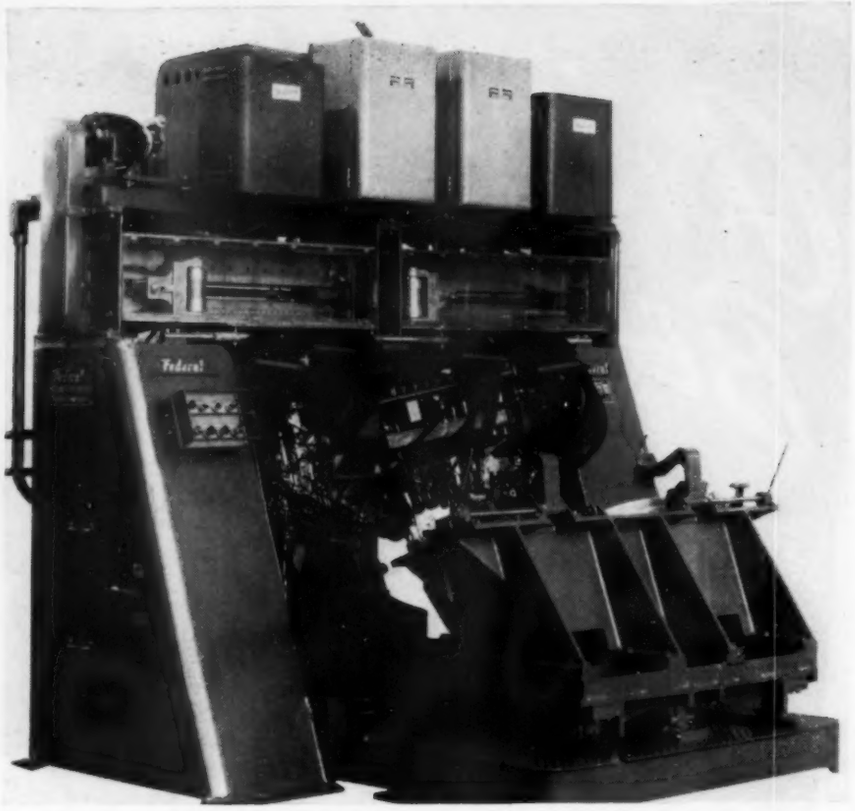
Vertical Post of Microscope Tilts for Thread Checking

The Wilder toolmakers' microscope is offered by George Scherr Co., Inc., 200 Lafayette St., New York 12, N.Y. Instrument consists of a Meehanite base and post on which the microscope bracket is vertically adjustable by spiral rack and pinion. An additional vertical adjustment of the microscope tube within the bracket is provided for greater capacity.

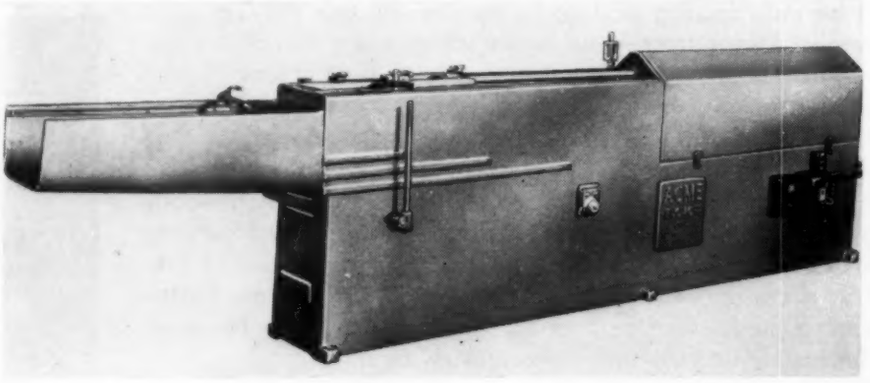
Microscope tube provides a standard magnification of 30x for the image of the work. The standard reticule in the eyepiece contains a 90° hairline cross and a 60° angle cross for thread measurements. To facilitate thread checking, the vertical post with microscope and bracket can be tilted to the helix angle of the thread. Measurements in two directions are by 1-in. heavy-type screws that read directly to 0.0005 in. A longitudinal range of 2 in. is provided. Equipment includes both understage and surface illumination.

Steel Radius-Extension Bar Made for Flash-Circle Burner

A radius-extension bar made for the Flash-Circle burner, is offered by Scientific Research Co., Box 19, 1618 N. Vancouver Ave., Portland 12, Oregon. Bar is made of rigid cold-rolled steel with the adapter permanently fixed to the bar by induction silver soldering. Bar is cadmium plated to prevent rust. Called the Special extension bar, it can be used to cut circles to 60 in. in dia., which with the 8-in. length of the torch-radius bar, equals 30 in. as a possible radius using one extension bar.



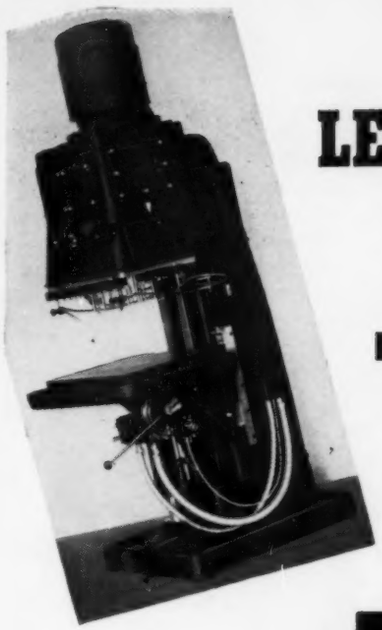
MULTIPLE-SPOT WELDER for welding automobile-dash panels is made by The Federal Machine and Welder Co., Warren, Ohio. Machine utilizes two ultra-speed units, two water-cooled transformers, and 76 hydraulically operated welding guns. The carriage unit with locators for positioning the work parts, moves in and out of the welding position by means of a hydraulic cylinder. As carriage is positioned, hydraulic valves automatically initiate welding guns which move into position. Production is said to be 80 parts per hr.



Acme Hydraulic Broaching Machine Handles Broaches Up to 60 in. Long

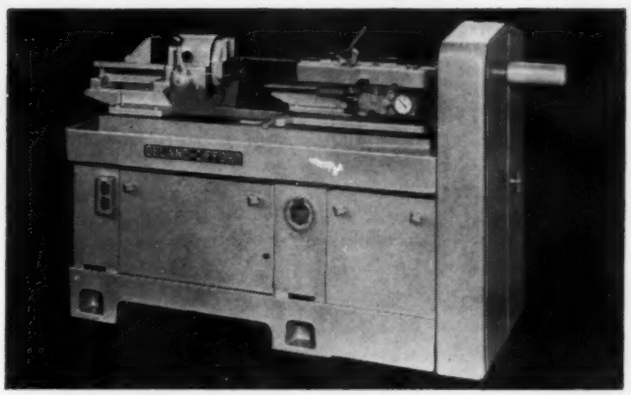
The Acme Broach Corp., E. Third St., at Delaware, Lexington 47, Ky., introduces horizontal hydraulic broaching machines built in 6-, 10-, 15-, and 20-ton capacities, having a 54-in. stroke. Machines will handle broaches to 60 in. long. Featured is an adjustable sliding head.

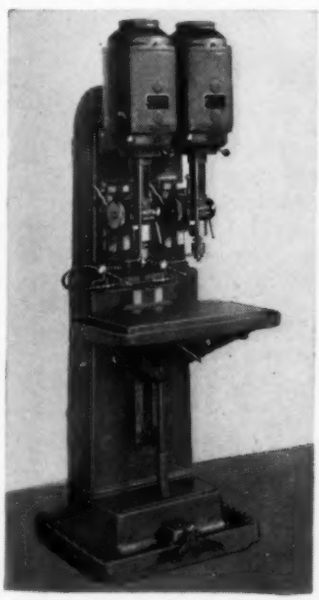
Tubular-type steel cylinders are said to assure freedom from leaks. The main pulling cylinder is in direct line with the faceplate bore assuring straight pull and minimizing broach breakage. The oil pump is not submerged in oil, eliminating the necessity of draining oil for removal or repair of the pump. The machine contains a built-in speed-control valve for adjustment of the cutting speed.



THE LELAND GIFFORD LINE

includes a drilling machine
to meet your every need.
Individually motored spindles
Speeds instantly selected
Wide speed ranges





NO. 1 SUPER HIGH SPEED

NO. 2 TO CAPACITY OF NO. 2 M.T.

NO. 3 TO CAPACITY OF NO. 3 M.T.

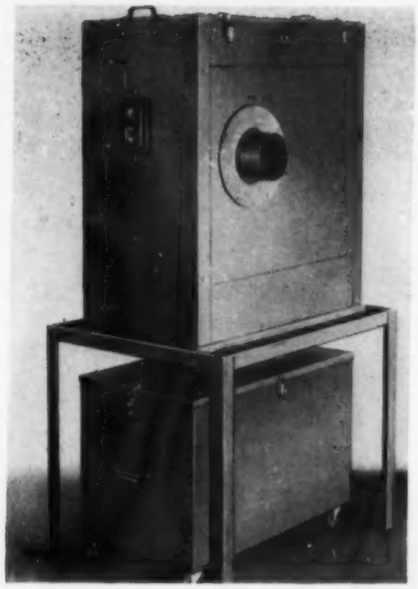
NO. 4 FOR HEAVY DUTY

. . .

VERTICAL AND HORIZONTAL
DEEP HOLE DRILLING MACHINES
16 SPINDLE ADJUSTABLE

LELAND-GIFFORD

WORCESTER 1, MASSACHUSETTS, U. S. A.



SELF-CONTAINED Dustkop dust collector with a large-volume dust-storage capacity is made by Aget-Detroit Co., Ann Arbor, Mich. Model 11B50 employs a roll-a-way bin with clamp-down cover. Actual suction capacity on a 6-in. inlet is 1394 cfm. at 3.2 static suction. Total space required for the unit is 24x40 in.; height is 72 in.

Wales Sheet-Metal Fabricator Punches, Notches, Bends, Forms

A sheet-metal fabricator is offered by Wales-Strippit Corp., North Tonawanda, N. Y. Machine punches, notches, nibbles, bends, forms, and blanks. Wales self-contained units form the nucleus of the fabricator. A self-contained holder slides on ways in the press bed. Various punches and dies are interchangeable in the holder. Three dies of various clearances are provided for each punch to accommodate material up to 3/16-in. thickness. Burring operations are said to be eliminated with the Wales "Quick-Change" system.

Fabricator was designed with a 5 13/32-in. opening under the ram to permit using the standard Wales type BL hole-punching units and Wales Type NA notching units. The Hydra-New-Matic head is said to operate with a minimum of vibration at 165 strokes per min. for single-hole punching and for nibbling.

A slug-clearance tube hole in the lower-left side of the press frame directs slugs to out-of-the-way containers. Complete sets of graduated punch assemblies and dies are within operator's reach on the two revolvable storage spindles.

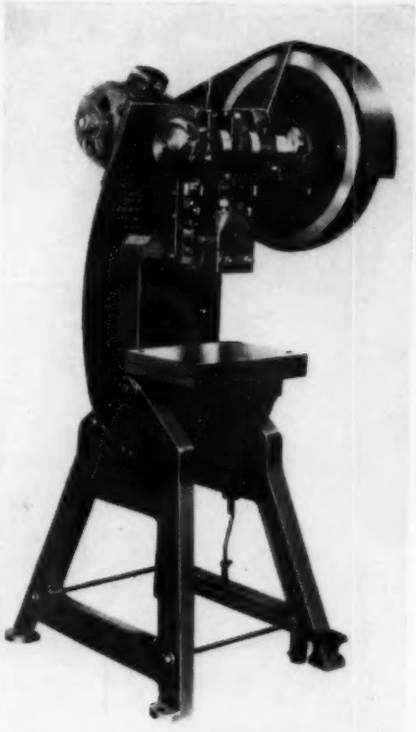
Electrode for Mild Steel Operates in All Positions

An all-position arc-welding electrode for welding of mild steel is offered by Wilson Welder and Metals Co., Inc., 60 E. 42nd St., New York 17, N. Y. Listed as No. 109, electrode is available in 1/8-, 5/32-, 3/16-, 7/32-, 1/4-, and 5/16-in. diameters. The No. 109 is said to give a minimum of spatter with either ac. or dc.

Automatic Buffer, Polisher Head Indexes at Pre-Determined Speeds

An automatic electrically powered buffing and polishing machine has been developed by Vanott Machine Corp., 234 Colgate Ave., Buffalo, N. Y., said to be capable of finishing 800 parts per hr. Machine finishes small objects with diameters to 3 in., or up to 7 in. if only four spindles are used.

The V-8 buffing machine has eight spindles on a revolving head which indexes at pre-determined speeds. Each spindle is provided with a chuck, or a gripping device, individually designed to hold work.



Improved Press-Rite Presses Feature Single-Stroke Clutch

The improved line of Press-Rite presses is announced by Sales Service Machine Tool Co., 2363 University Ave., St. Paul 4, Minn. Also offered is the No. 12, 12-ton press. All presses, with the exception of the No. 0 press, are now built with anti-friction roller bearings in the flywheels. Featured is a single-stroke clutch, together with an automatic brake. The clutch dog engages a 4-point steel ring attached to the flywheel hub. Clutch can be used either for continuous operation with automatic feeds or operated as a positive single-stroke clutch.

The clutch-engaging and -disengaging pawl is operated by a cam built in the crank-drive integral collar of the crank. Cam revolves with the crank and when clutch is tripped, the disengaging pawl is locked in a positive position until the clutch dog is disengaged out of the clutch-drive ring. Treadles for clutch must be completely released to an upward position before clutch can be tripped for second stroke.

INVESTMENT RETURN 125% PER YEAR!

on the Monarch Mona-Matic with Air-Gage Tracer and Rear Tool Slide

Action-compelling news for all production men! A customer tells us he's replacing *six* modern lathes (four of them only slightly more than a year old) with *two* Monarch Mona-Matics.

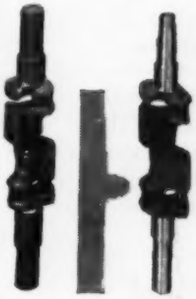
On the basis of actual performance, this installation shows savings more than sufficient to pay for the machines, together with all tooling and templates, the first year.

Such savings are possible because:

1. The completely automatic cycle permits one operator to service a battery of two machines *easily*, thereby doubling output per machine.
2. The Air-Gage Tracer provides single-point, *uninterrupted-cut* metal turning at a rate of output not possible on other types of machines.
3. No time is lost in needless second operations.
4. Setup time never exceeds ten to fifteen minutes.
5. Tool investment and tool sharpening time hit a new low.
6. An important plus—the Air-Gage Tracer guided cutting tool often reduces the amount of grinding stock by more than half.

Ask us to show you how investing in the Monarch Mona-Matic will save *you* money in a BIG way.

THE MONARCH MACHINE TOOL CO. • SIDNEY, OHIO



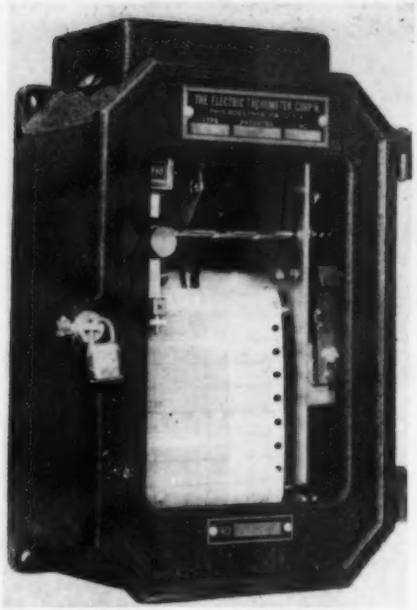
JOB FACTS . . .

SAE 4140 steel forged crankshaft 16⅜" long; each end completely finish-turned for grinding in one operation, using carbide cutting tools. Tolerance—.002". On a battery of two machines, actual machining time per shaft averages .62 minutes.

ACCURACY - ECONOMY - LONG LIFE

Monarch TURNING MACHINES

FOR A GOOD TURN *FASTER* — TURN TO MONARCH



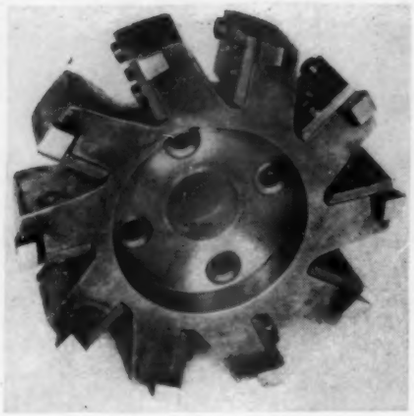
Electrically Operated Recorder Gives Speed, Production Record

A speed and production recorder, Model R-300-H, has been developed by Electric Tachometer Corp., 22nd and Vine St., Philadelphia, Pa. The gear-driven unit is electrically operated and produces a permanent record of speed and production. The recorder consists of a synchronizing contactor which can be attached to and driven by the prime mover or industrial machine. A step-by-step motor in the recording instrument is electrically connected to the contactor and follows its motion. Motor drives a steel stylus across the wax-coated chart.

At ½-min. intervals the master clock, makes contact to disengage the feed screw which is revolved backwards by a return spring restoring the pen arm to zero. The same contact feeds the chart downward at the rate of 2 in. per hr. Recorder shows irregularity in speed as well as idle time.

Seam-Welding Electrode Metal Offered for Resistance Welding

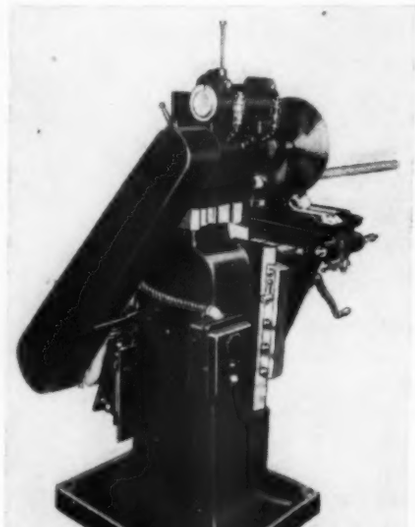
P. R. Mallory & Co., Inc., Indianapolis, Ind., offers the Mallory 22 metal, a high-conductivity copper-base alloy containing cadmium and zirconium. Mallory 22 metal is a seam-welding electrode metal for resistance welding. Metal is said to offer high-conductivity, hardness, and resistance to annealing, making it useful for coated metals as well as carbon steel. It is available as forged blanks or finished machined wheels in a variety of sizes.



Type B Face-Milling Cutter For Face or Step Milling

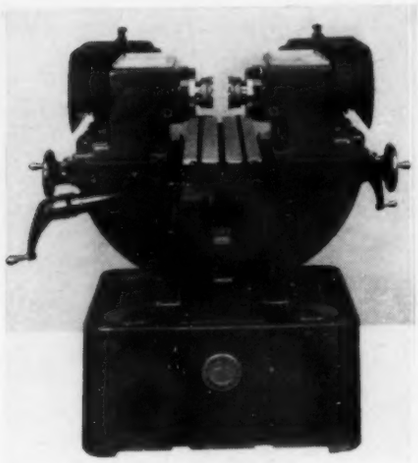
Kutscha Cutter Co., 621 West 74th St., Chicago 21, Ill., offers the Type B face-milling cutter having inserted blades for carbide-tipped bits. Cutters are built for circular milling, or by adjustment for step milling, radial as well as axial.

Blades of high-speed steel can also be used. Blades have tapered ends for abutment of adjusting set screws. Cutters are available in sizes from 6 to 14 in. in diameter.



High-Speed Hand-Feed Type Miller Cuts Plastics, Non-Ferrous Metals

A high-speed hand-feed milling machine is offered by United States Machine Tool Co., Cincinnati, Ohio, for cutting plastics and non-ferrous metals. Machine attains a speed of 3500 rpm., and is adaptable to high-speed cutting of aluminum bars and tubes as well as cutting plexiglas, lucite and other plastics. It is said to cut through 2-in. aluminum castings in 1.5 sec. The table has a 16½-in. horizontal travel. Machine is said to be accurate to 0.001 in.



Two Opposed Independent Heads Offered on Nichols Twin Miller

A twin miller is offered by W. H. Nichols Corp., 50 Church St., New York 7, N. Y. Machine is a double-spindle high-precision miller for light-duty work where two surfaces can be milled in a single pass. Machine has two opposed independent-geared milling heads powered by pancake-type motors, each offering 15 spindle speeds from 55 to 2080 rpm.

Each milling head is adjustable in three planes. Maximum height of spindle centerline above table is 12 in., minimum height is 1½ in. Machine requires 4 x 5 ft. of floor space and is 55 in. high. The maximum distance between spindle noses across table is 16 in.; the minimum distance is 4 in. The 8½x34-in. table is powered by a solenoid-operated air cylinder.

Light-Duty Type Cutter Blade Furnished in Solid Carbide

A light-duty cutter blade, made by Weddell Tools, Inc., Rochester 11, N. Y., has been added to their line of triangular-shaped cutter blades. Known as the ⅜-in. Tri-Bit, it is furnished in solid carbide only. Illustrated is its application to small shell-type face mills or solid-shank end mills. Toolbit is locked into a V in the triangular-shaped hole by a lock screw. The minimum size shell end mill has a 12-in. dia., ¾-in. bore, with 10 adjustable blades. Solid-shank end mills are furnished 1-in. dia. and up.

J&L COLD-FINISHED
JALCASE

—the Original, Open-Hearth, Free-Machining Steel

J&L STEEL

—best in
MACHINABILITY

—best in
PHYSICAL PROPERTIES

—best for
HEAT TREATING
(*Induction or Conventional*)

There's more than a quarter of a century of research and experience behind every ton of J&L JALCASE Steel!

Cold-finished JALCASE—the forerunner of *all* free-machining, open-hearth steels—was originated in the J&L Metallurgical Laboratories more than a quarter of a century ago as a practical solution to the problem of machinability. This development resulted in an open-hearth steel with cutting and machining qualities closely approaching those of Bessemer steels.

Acclaimed, from the very beginning, for its outstanding properties, JALCASE *still is the outstanding steel in its class today!* Its performance is unsurpassed when compared with that of similar steels.

JALCASE is available in many grades, each of which is applied to suit the application. Typical JALCASE analyses are found in the A.I.S.I. 1100 series wherein the manganese content is 1.00% to 1.65%, such as in Grades C-1117 through C-1144.

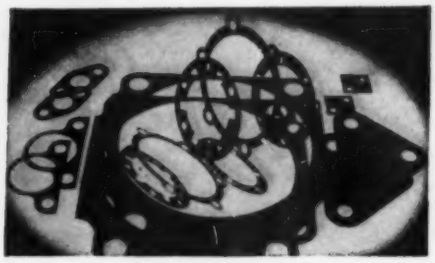
JALCASE is supplied as cold-drawn or cold-drawn-with-metallurgical-processing such as special and varied tempering treatments. These thermal treatments are designed to improve physical properties, machinability, provide minimum distortion and increase wear resistance. Thus, many parts made of this material may need no further heat treatment after machining.

Let us send you complete information on JALCASE—the *modern* free-cutting steel. Write to: Jones & Laughlin Steel Corporation, 402 Jones & Laughlin Building, Pittsburgh 30, Pa.

JONES & LAUGHLIN STEEL CORPORATION

AMERICA'S FOREMOST PRODUCER OF FREE-CUTTING, QUALITY STEELS

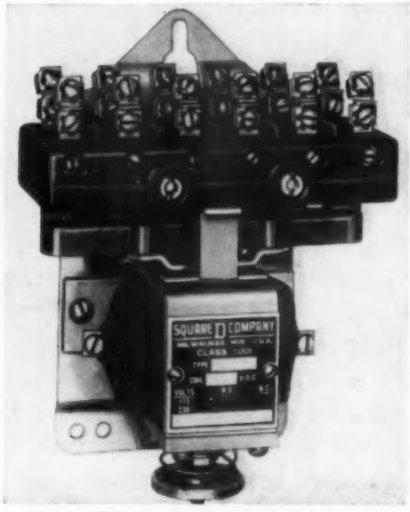
Parts and Materials



Steel, Copper, Brass Shim Sets Furnished in Any Shape or Size

A standard set of shims which can be furnished in any shape and size with any arrangement of bolt holes, is offered by U. S. Gasket and Shim Co., Hudson, Ohio. Each of these standard sets consists of one 0.020-in. shim, three 0.005-in. shims and three 0.007-in. shims.

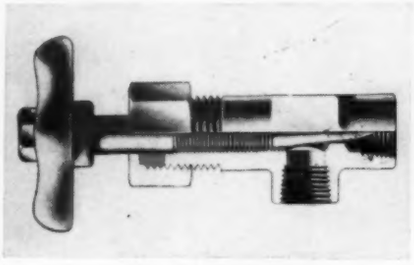
Shim sets can be fabricated of steel, copper, brass, monel as well as any other ferrous or nonferrous material. Individual shims can range from 0.001 to 0.25 in. in thickness and over-all shape size can be from ⅜ in. to 6 ft. Tolerances are held to 0.015 in. for over-all shape and for bolt-hole location.



Dc. Magnetic Multi-Pole Relays Utilize Double-Break Contacts

Two dc. magnetic multi-pole relays are offered by Square D Co., 4041 N. Richards St., Milwaukee 12, Wis. Straight-line vertical-solenoid action is said to minimize the effects of shock and vibration. Relays utilize double-break silver-to-silver contacts which can be easily converted from normally open to normally closed without additional parts or tools. Contact parts are interchangeable with those of the corresponding ac. devices.

Listed as Types Q and R, relays are suitable for operation on dc. voltages up to 250 v. Type Q is available with from 2 to 6 poles, and Type R with from 2 to 5 poles in any combination of normally open and normally closed circuits. Type R is somewhat larger and heavier than Type Q.



Bulldog Needle-Type Valve Features Very Fine Thread

Carpenter Mfg. Corp., 9523 Detroit Ave., Cleveland, Ohio, introduces the Bulldog needle valve built with a stainless-steel stem, and featuring a long taper. For flow control, a micrometer thread is machined on the stem with 40 tpi. Control is held to 0.0001-in. accuracy. Bodies are machined from solid bars. Threads are a Class 3 fit.

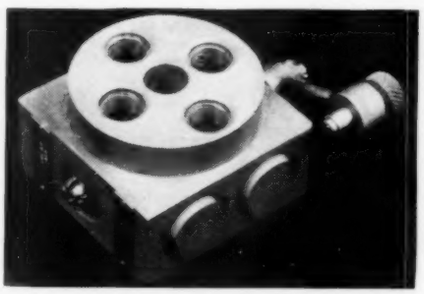
Chemical Material Cleans, Deodorizes in One Operation

A chemical material for cleaning and deodorizing in one operation is marketed by Oakite Products, Inc., 124 Thames St., New York 6, N. Y. Called Di-Sanite, it is a fine, free-flowing powder. The material is soluble in hot or cold water and is said to possess wetting, penetrating, and detergent ability, as well as deodorizing action. Material is said to be free from abrasives and harmful ingredients, and can be applied by sponging, wiping, or mopping. Material has no odor of its own.

Wax-Slug Type Tap Cartridges Are Extruded Carrying Chips

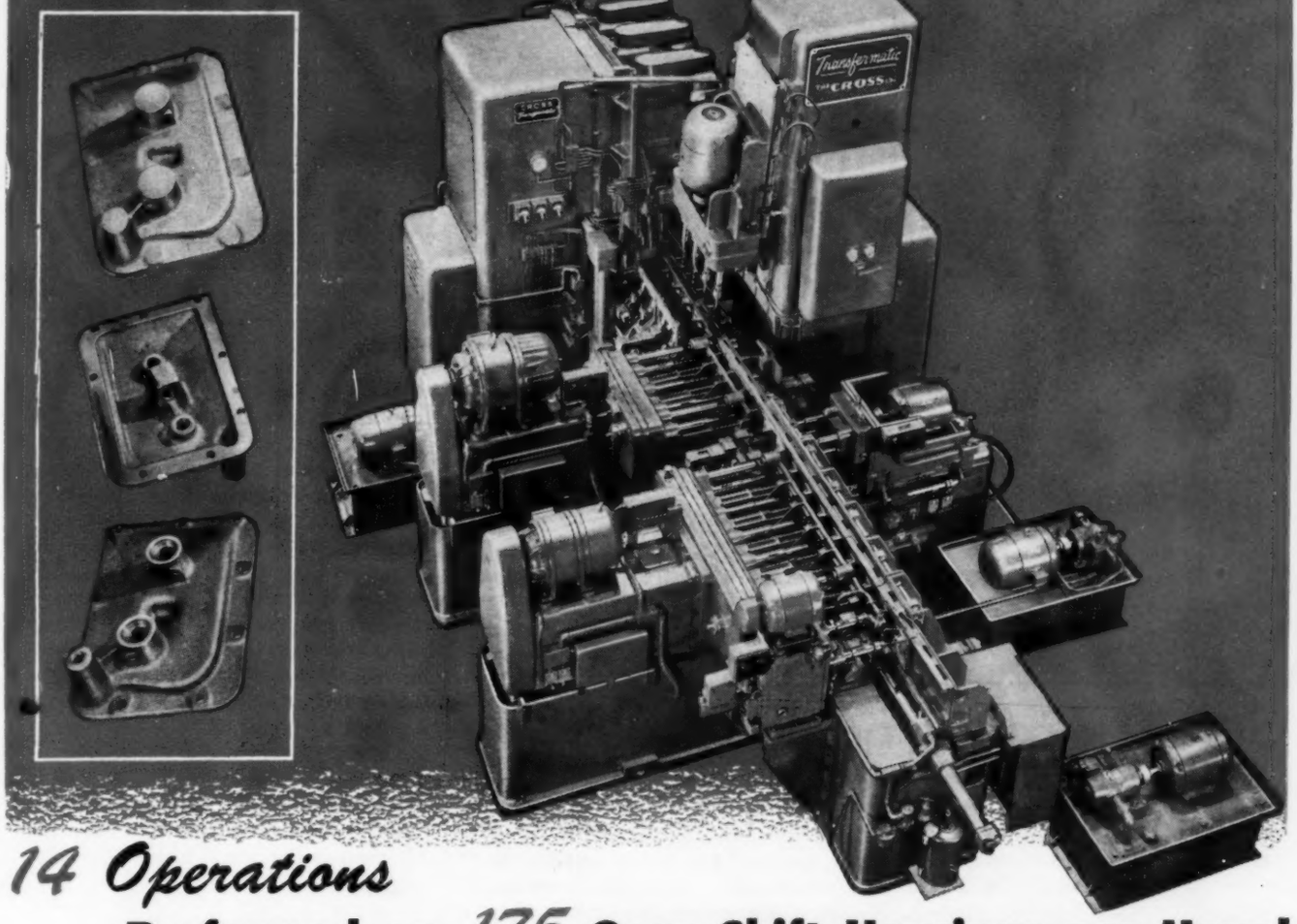
Tap cartridges, which are wax slugs placed in blind holes before tapping, are offered by The Foulk Mfg. Co., 4208 Airport Rd., Cincinnati, Ohio. When tapping, cartridge is extruded up along the flutes of the tap carrying the chips out of the hole. Cartridges can be used for plastics, ferrous, and non-ferrous materials.

The toolroom kit includes a variety of sizes for 5-40 to and including ½-13 thread. The complete kit is priced at $10.



4-WAY SELECTOR VALVE, made by Electrol, Inc., Kingston, N. Y., is designed to control flow to the remote actuating cylinders of hydraulic systems. Valve has four line connections and includes a group of spring-loaded balanced-type poppet valves interconnected by ducts, which direct the fluid to desired channel. Actuated by cams, valves are arranged so that rotation of camshaft opens proper combination of poppets to direct fluid to desired location. Efficient ducting of fluid and reduced pressure drop are assured by the coaxial assembly and the adequate passage size

Another Transfer-matic by Cross



14 Operations

Performed on *175* Gear Shift Housings per Hour!

After one of the "Big Three" automotive companies "consulted Cross to cut costs" we designed and built this special Transfer-matic to machine transmission gear shift housings. Attended by only one operator, it simultaneously performs 14 operations on a total of 28 parts to produce 175 housings per hour at 80 per cent efficiency. The operator merely presses the control button and the machine does the rest—even automatically moving the parts from station to station.

This Transfer-matic is another example of Cross originality in creating special machine tools to achieve the utmost in profitable productivity.

PART: Transmission Gear Shift Housing.
OPERATIONS: 14 progressive operations to machine housing completely except for joint face.
PRODUCTION: 175 pieces per hour at 80% efficiency with one operator.
EQUIPMENT: Cross Special Transfer-matic.
FEATURES: ☆ Minimum physical and mental effort required from operator ☆ 28 pieces machined at one time progressively ☆ Parts are transferred, located, clamped and machined two at a time—all automatically ☆ Chips are conveyed to outside of machine ☆ Complete automatic lubrication with each machine cycle ☆ Reasonable flexibility for part design change through use of standard Cross units ☆ Low maintenance because of many standardized parts, easy accessibility of wearing parts, and interchangeability of self-contained units.

Investigate Cross Transfer-matics—the newest machine tool development for continuous automatic production.

THE CROSS COMPANY

Established 1898

SPECIAL MACHINE TOOLS

MILLING • DRILLING • TAPPING • BORING • TURNING • SHAPING • GRINDING • HONING

DETROIT 7, MICHIGAN

OUT OUR WAY
WELL, WE'RE DOWN TO OUR LAST TWENTY BAGS OF SOL-SPEEDI-DRI, AND I DIDN'T WANT TO BE CAUGHT---
WELL, ORDER SOME MORE! ORDER A DOZEN CARLOADS! TWENTY, IF YOU NEED 'EM!
BEIN' A BIG EXECUTIVE DON'T LOOK SO HARD-- JUST HOLLER, "GIT IT! GIT WHUT YOU NEED!"
THAT'S TH' KETCH--IF YOU NEED 'EM! BUT, BOY, HE DON'T HAFTA WORRY! WE KIN ALLUS USE SOL-SPEEDI-DRI AROUND TH' SHOP!
J.R.WILLIAMS
AUTHORITY
COPR. 1948 BY NEA SERVICE, INC. T. M. REG. U. S. PAT. OFF.

YOU CAN COUNT ON SOL-SPEEDI-DRI

American industry has learned that it can depend on the uniformly high quality of SOL-SPEEDI-DRI—the field's original and foremost absorbent for all liquids. This quality is guarded carefully from mine to user by the most modern methods and equipment. The raw material for SOL-SPEEDI-DRI is obtained by *selective* mining, and is transformed, under constant laboratory control, into the finished product. There's no waste in SOL-SPEEDI-DRI. Packed in special moisture-proof bags, every grain of SOL-SPEEDI-DRI comes to you at the peak of efficiency to give you the most for your money.

SOL-SPEEDI-DRI has been tested and proved by American industry. The result? More SOL-SPEEDI-DRI is used by the nation's shops and plants than any other material of similar nature! That's ample proof of SOL-SPEEDI-DRI'S out-in-front performance. Remember, if SOL-SPEEDI-DRI is *on* the bag, quality is *in* the bag!

WHEN YOU BUY, BE *SURE* IT'S SOL-SPEEDI-DRI!

Safety and Maintenance Co., Inc., No. 1 Wall St., New York 5, N. Y.

Warehouse Stocks Maintained in Principal Cities of the United States and Canada

ROUND TABLE *Discussion*

EXPERT OR EXECUTIVE?

If the only qualifications needed for foremanship were technical and manufacturing knowledge, then a foreman ought to be expert in the use of one or more machine tools and have a general knowledge of all machines to be a good supervisor. The foreman's job, however, should be to direct rather than to perform and his time should be so employed. To pitch in, unless in a case of real emergency, is to indicate that his mental outlook is that of a workman rather than that of a foreman.

The captain of a ship may have but slight knowledge of engine-room work or of catering for passengers, but he can direct, steer his ship, and take it just where he wants to. The services of the engineer and steward are necessary, but they are subordinate to the direction of the captain.

This matter was dealt with by Taylor in his works on scientific management. To some extent, the foreman's duties are works management, and a foreman in respecting his job will be respecting himself. In turn, his men will respect him. This way lies success.

J. E. Powell
Lincoln, England

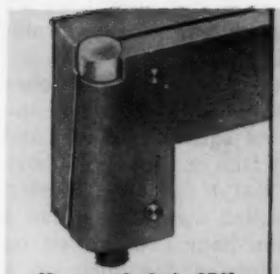
•

EASE IN OR BREAK IN?

When I think of breaking in a new man I always reflect upon my own inherent timidity in the earlier days of my shop experiences. There was no consideration shown me by the boss or the men in the shop. I was just another two-legged addition with a tender heart, heartlessly dumped in the fathomless pool of industrial throat-cutting.

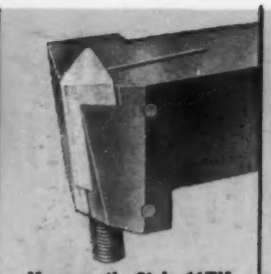
From the foreman's standpoint, I was another victim of his physical indisposition. This Simon Legree of the countershaft days of long ago would arrive at my bench after I had donned my overalls and scare the living daylights out of me by slamming a chunk of steel or casting thereon. After outlining what he wanted done, incidentally informing me that he had done the job in record time and with unbelievable precision, he would shove me in the deep water, so to speak.

The men around me merely considered me as another competitor to



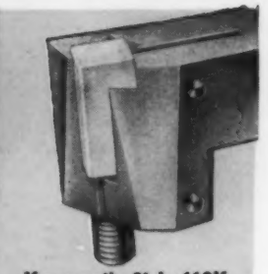
Kennamatic Style 3RK

Kennamatic Style 3TK

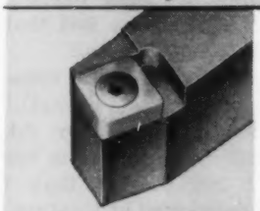


Kennamatic Style 11TK

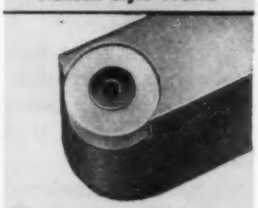
Kennamatic Style 9TK



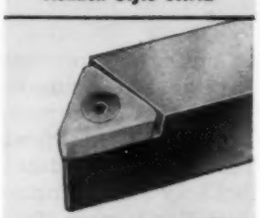
Kennamatic Style 11SK



Kendex Style 11SKD



Kendex Style 3RKD



Kendex Style 3TKD

Kendex Style 11PKD

Here They Are...

KENNAMETAL Developments in Mechanically-Held Tooling

for Better Production at Less Cost

Kennametal mechanically-held tools are outstanding in their performance, and in the savings they effect, because:

THEY ELIMINATE THERMAL STRAINS

The inherent strength of Kennametal is more fully utilized. Harder grades can be used on heavy jobs at coarser feeds.

THEY SIMPLIFY TOOL SETTING

Tips can be repositioned, or replaced, without disturbing the tool holder.

THEY REDUCE GRINDING COSTS

Procedure is simpler and less frequently required. No steel needs to be ground—only the carbide. Indexing feature of Kennamatic and Kendex tools provides multiple cutting edges between regrinds.

THEY LOWER INVENTORY

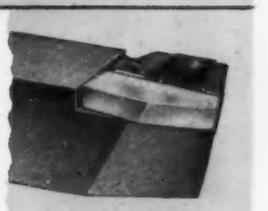
Fewer tools are required to float a specific job, and only tips or inserts need to be stocked.

THEY INCREASE MACHINE PRODUCTIVITY

Down time is minimized because fewer tool changes and adjustments are required.

Our field representatives are fully equipped to help you apply this advanced tooling technique for better production at less cost. Ask them to demonstrate.

The tools illustrated are made in both hands, in various sizes, with Kennametal tips suitable for machining steel, cast iron, and non-ferrous alloys.



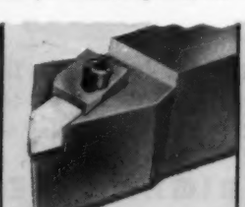
Clamped-on Style 12H

Clamped-on Style 40H

Clamped-on Style 2H

Planer Tool Style 11 PH

Planer Tool Style 9PH



Planer Tool Style 59PM

"Universal" Face Kennamill

"AF" Axial Face Kennamill

Does KENNAMETAL Inc. Manufacture Brazed Tools, and Blanks?

Yes—Kennametal Inc. produces and sells directly to the user a greater number of different carbide tools of both brazed and mechanically-held types than any other manufacturer.

It's the "KENNAMETAL" That Makes the Tool

Send for Catalog 48

It shows the most complete and diversified line of carbide tools ever offered.

KENNAMETAL Inc.

SUPERIOR CEMENTED CARBIDES

LATROBE, PA., U. S. A.

Gears for every industry are precision cut to your specifications. Racks . . . sprockets . . . spur . . . bevel . . . spiral . . . Zerol . . . worms and worm gears. Send blue prints or samples for prompt estimates on any quantity.

E. B. SEWALL MANUFACTURING CO.
688 Glendale St. St. Paul 4, Minn.

ANY SPEED ... AT THE TURN OF A KNOB

PICK ANY SPEED WITHIN THE RANGE (250 to 1000, 360 to 1440, 545 to 2180, 875 to 3500 R.P.M.)

THE RIGHT SPEED ALWAYS COSTS LESS

TWO MODELS - 1 to 6 spindles
M-96 (shown) cap. ⅞
M-125 cap. 1¼

THIS BULLETIN TELLS ABOUT THIS BETTER CONTROL

EST. TF 1834

THE TAYLOR & FENN CO.
HARTFORD 1, CONN.

11TF48

be regarded with suspicion. I wasn't told that this or that lathe was awaiting to be retired at 65, nor was I informed of the many slipping clutches above; I was just planted in the strange soil of squeaking belts and told to grow. One or two of the boys registered a sort of pseudo friendship when I informed them that I had a card. At noon hour I would sit on the bench alone and munch on a cold lunch while my ears burned. Finally, the boys made me feel that life was worth living after all.

It is no wonder that with these memories of days of yore that I share the views expressed by Ed. Were his philosophy practiced in the olden days, I am certain that I wouldn't have developed at least two of the wrinkles that now adorn my brow.

The initial cost of breaking a new man in will certainly pay dividends. I believe in showing a human being at least the same consideration that I would show a new car.

John Homewood
Ontario, Calif.

•

I think most intelligent foremen these days believe in the easing-in process with regard to new men, particularly where the men are hired by a personnel manager at the front office, because a likely looking prospect with a smooth line is more likely to be put to work than his less articulate brother, who possibly has more to offer.

The foreman can be fooled, too, by the fellow who talks a good game, but the chances are slimmer. Either way, the easing-in protects employer and employed. It gives the new man a chance to become adjusted to new surroundings, and it protects the company from the cost of unnecessarily scrapped work.

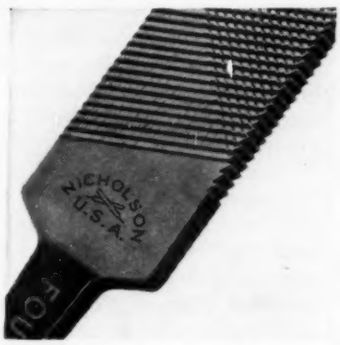
Orientation is good physchology. It gives the new employee a comfortable feeling to be shown around and introduced to his fellow workmen. He, in turn, will usually do his best to create a good impression and turn in a good day's work. The exceptions to this rule are few and far between; most men react favorably to good treatment.

I recall my own experience when going to work on a new job; first, the waiting outside the shop gate on a raw winter morning until the foreman was ready to see me; then, when the hiring formalities were dispensed with, I lugged my heavy toolcase in the wake of this self-important individual to a dark and drafty corner of the shop, where, in the early morning gloom, we stopped be-

"KNOW YOUR FILES and CUT COSTS"

It's the cost of the workman's time that counts in filing operations. This is one of a series of advertisements on special-purpose files. Save it for shop and purchasing reference.

Subject: FOUNDRY FILES ...ared by Nicholson File Co.



Flat Foundry File

Half Round Foundry File

Filing Foundry Casting

FOUNDRY FILES VS. REGULAR-PURPOSE FLAT FILES. It has always been recognized that "regular" files are not designed to stand the abuse encountered in foundry filing. Their teeth are comparatively high and sharp, and are made for general removal of stock where speed is the main requisite. In foundries, however, the main filing job is snagging castings. When a casting comes out of the mould, it has all sorts of fins, knobs, sprues, sharp edges and other projections. Sudden chilling and sand which becomes a part of the casting make these projections hard and abrasive. The average file cannot stand this severe usage without "shelling off," "breaking out" or wearing down rapidly. Its use on foundry castings is a waste of good file teeth — and, consequently, a waste of money.

FOUNDRY FILE CHARACTERISTICS. Looked at casually, Nicholson and Black Diamond Foundry Files do not appear to differ greatly from regular-purpose files of corresponding shapes and sizes. But the difference is there . . . and it is important. Foundry files have extra-strong, rugged teeth which are not so high and sharp as the teeth of regular files. The Half Round shapes have heavier set edges, but the Flat shapes have regular edges.

USES AND PERFORMANCE. Nicholson and Black Diamond Foundry Files are widely used today not only for snagging castings in foundries, but also for filing narrow edges and sharp corners of dies, and for many other kinds of rough filing. While not cutting as fast as regular files on general work, they are specially made to last longer on the punishing jobs.

SIZES AND SHAPES. Nicholson and Black Diamond Foundry Files are regularly made in Flat and Half Round shapes (illustrated) and Bastard cut, but can also be furnished in Round and Square. Sizes 8" to 18". Identified by the word "Foundry" stamped on tang or shoulder. Available through your industrial distributor.

Nicholson makes special-purpose files for Brass, Lead, Aluminum, Stainless Steel, Foundry Castings, Die Castings, Die Making, Lathe Filing, Curved and Shear Tooth Filing—and Swiss Pattern files of all shapes and patterns.

FREE BOOK—"*FILE FILOSOPHY.*" Most widely known book in existence on kinds, use and care of files. Invaluable to production and purchasing heads.

NICHOLSON U.S.A. **NICHOLSON FILE CO., 29 Acorn St., Providence 1, Rhode Island** BLACK DIAMOND TRADE MARK

(In Canada, Port Hope, Ont.)

NICHOLSON FILES *FOR EVERY PURPOSE*

Uniformly Better Results in Heat Treating...

● Using the NIAGARA AERO HEAT EXCHANGER to cool quenching bath solutions returns the cost of the equipment quickly and gives a bonus in fewer troubles for the heat treating superintendent.

Controlling the temperature of the quench means a uniform product...fewer rejections. Ample cooling capacity independent of water supply eliminates shut-downs because of hot oil. The heat is transferred from the oil to air by the evaporation of a water spray. Only the water evaporated is used and 95% of the water cost is saved.

In hundreds of installations, quenching both small parts and large shapes, production has increased at lower cost. Units operate reliably for years without maintenance troubles in plants that run 24 hours per day.

Niagara Aero Heat Exchangers also give extra value in cooling jacket water for process equipment or engines, hydraulic equipment, electronic sets, controlled atmosphere processes, and many other applications.

Write for Bulletin No. 96-AM

NIAGARA BLOWER COMPANY

Over 30 Years Service in Industrial Air Engineering

405 Lexington Ave. New York 17, N. Y.

District Engineers in Principal Cities

INDUSTRIAL COOLING HEATING • DRYING

NIAGARA

HUMIDIFYING • AIR ENGINEERING EQUIPMENT

fore a large lathe, covered with a thick layer of dust, rust, and grease. "This was old Joe Soandso's lathe," my companion imparted. "He ran it for thirty years. Hasn't been used since he died six months ago." Then he handed me a blueprint he had tucked under his arm, and pointing to a huge pile of castings nearby said: "You can start on these; make 'em like the print says. If you need anything, ask some of the boys." Off he stalked to his warm office, leaving me with mingled feelings. I was a young journey man then with a depleted bank balance; that and my curiosity got the best of me. I found some cotton waste and rubbed down the old workhorse. It wasn't a bad old lathe once you got used to its tricks.

After I finally located the tool crib, which was in another building, and after waiting in line, the old-timer in charge eyed me suspiciously over his glasses: "You're new here, ain't you? Got your tool checks?" I confessed my ignorance of procedure. "Ain't supposed to give out tools without checks—see the boss." So off I went again on safari and finally ran my quarry to earth after considerable legwork. He dug up ten brass checks on a wire ring and sent me back again to see the old fellow, who, hearing the noon whistle blow, slammed down the tool-crib window as I approached.

I believe times have changed for the better in this respect and orientation and the easing-in process are part of a natural evolution toward improved employer-employee relationships. A recent talk with a foreman friend should bear out this contention. He told me that he had set aside certain jobs for easing in his new employees, and a week told him all he needed to know of a man's capabilities. Each job was rated a little more difficult as the week progressed, and a man's value to him was definitely charted. Orientation was a definite procedure with this foreman and labor ceased to be a problem; in fact, he has a waiting list of prospective employees.

Robert S. Alexander
Greenville, R. I.

•

Scientific orientation of the new worker to his job is evolving as the new tradition of job management. To bring in a new man and immediately start him off before he can get his bearings isn't fair to either the man or the firm. It is axiomatic that a confused and discouraged employee is unprofitable from the standpoint of management. Labor turnover has

CAMPBELL'S

New

LOW COST WET ABRASIVE CUTTING MACHINE

Wheel Guides • Separate Coolant Tank • Five Inch Wheel Flange • Automatic Work Stop • Automatic Coolant Pump Operation • Instantaneous Electro-Hydraulic Automatic Work Clamp

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MODEL 223

ACCO

TRADE MARK

CAMPBELL MACHINE DIVISION
AMERICAN CHAIN & CABLE

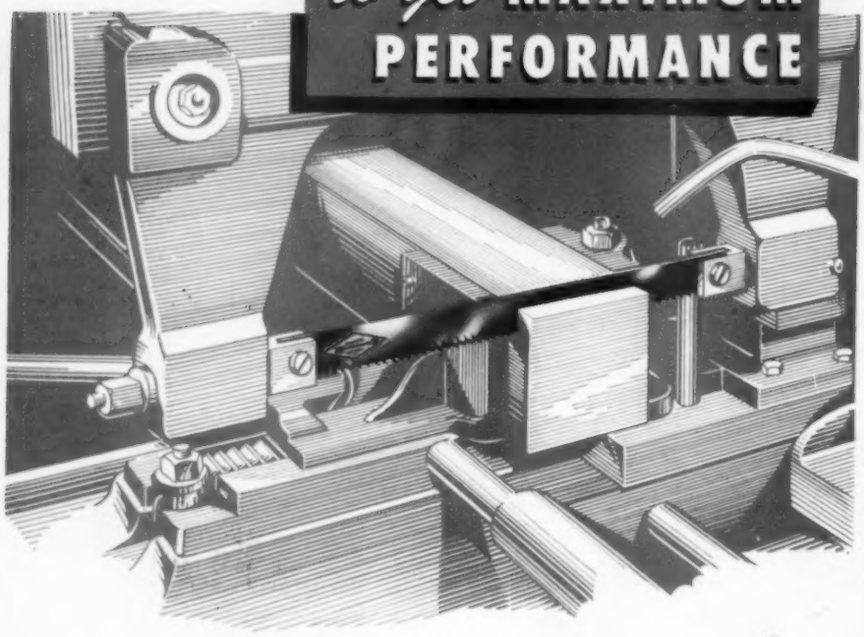
923 Connecticut Avenue, Bridgeport 2, Conn.

CAMPBELL
Abrasive Cutters and Nibbling Machines

You don't have to **"PUSH"**

BARNES HACK SAW BLADES

to get **MAXIMUM PERFORMANCE**



• It's not necessary to apply extreme tension to a Barnes power hack saw blade or drive it at excessive speeds or feeds to gain maximum cutting performance. Barnes blades have been job-proven as giving greater square inches cut per blade . . . faster, easier cutting with a minimum of effort.

Barnes blades give superior cutting when run at recommended speeds and feeds because they are made from the finest of steels by specialized techniques. They have accurately milled tooth form, uniform set throughout entire blade length, and cutting edges hardened in closely controlled processes. In addition, Barnes individual inspection assures you that every blade you buy will have all of the qualities for maximum cutting efficiency.

Your Barnes Distributor carries a complete selection of quality blades for every metal cutting requirement. He will be glad to recommend the proper type for your operation.

The Barnes Hack Saw Production Calculator, free on request, will help you get the most from your power hack saw. Write for it on your letterhead today.

BARNES Established 1919

W. O. BARNES CO., INC.

1297 TERMINAL AVE. · DETROIT 14, MICH.

been found to be highest among new men.

The employee is most apt to quit during the first few weeks he is on the job. The job always looks more difficult and less attractive to anyone while he is getting acquainted with it. When a man comes on a job, there are many things he must get used to. He feels strange and out of place and does not know the men around him. He is unacquainted with the rules and regulations of the shop, and is in constant fear that he will do something he should not.

The initial employment stage offers the foreman a wonderful chance to make a hit with a man by handling him in a kind and courteous manner, and it will also make a valuable contribution to the development of an efficient and satisfied worker. The foreman usually earns or loses the loyalty of his men by the way he treats them while they are green, at the time when they are hungry for a friend.

First impressions mean more to us than we realize. The first impression a new man gets is apt to stay with him. He not only sizes up the foreman when he starts work, but he passes judgment on the company by the treatment he gets.

The foreman should realize that he holds the reputation of the company at stake because the company is judged by its representatives. The foreman is the representative of the company in the shop.

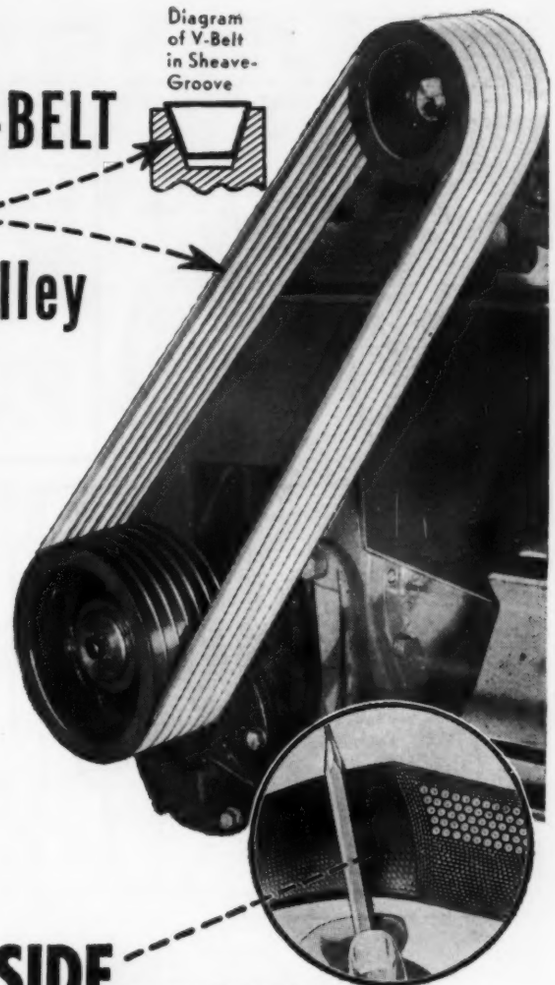
New men are bound to be expensive. How expensive they are depends upon how they are broken in on the jobs. If a new man is left to himself to "pick up" his job as best he can with little instruction from the foreman, he will be a very expensive man for the company. A new man will cost the least when he is carefully broken in and taught to do his work the right way first.

Unless the new man is carefully instructed, he will spoil material. The time to impress a man with the importance of quality workmanship is when he starts to work. Quality should be put ahead of quantity because the new man should first learn to do his work right. Speed will come with practice.

In addition, it is a well-known fact that accidents are more apt to happen to a new man than to a man who is experienced. Accidents to new men can be largely avoided if the men are carefully instructed regarding the dangerous points of the work they are undertaking.

In plants that do not make use of any definite method of indoctrination of new employees, the new men

The SIDE of a V-BELT is what GRIPS the pulley



Naturally, it GETS the WEAR!

Any one familiar with V-Belt drives knows that the sides of a V-Belt are what really get the wear.

It's the *sides* that grip the pulley. They *pick up* all the power from the driver pulley, *transmit* that power to the belt as a whole and then, once more, they *deliver* the power to the driven pulley. And, clearly, it's the *sides*—and *only* the sides—that take the wear against the sheave-groove wall.

That is why you have always noticed that the *sidewall* of the *ordinary* V-Belt is the part that *wears out first*—and, naturally, if you prolong the life of the sidewall, you *lengthen* the *life* of the *belt!*

Now See How the CONCAVE SIDE (A GATES PATENT) SAVES Sidewall Wear and Lengthens Belt Life!

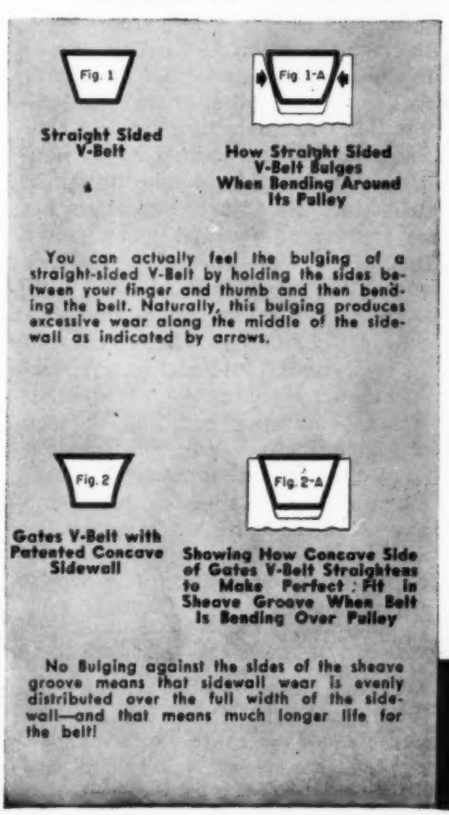


Fig. 1
Straight Sided V-Belt
Fig. 1-A
How Straight Sided V-Belt Bulges When Bending Around Its Pulley
You can actually feel the bulging of a straight-sided V-Belt by holding the sides between your finger and thumb and then bending the belt. Naturally, this bulging produces excessive wear along the middle of the sidewall as indicated by arrows.
Fig. 2
Gates V-Belt with Patented Concave Sidewall
Fig. 2-A
Showing How Concave Side of Gates V-Belt Straightens to Make Perfect Fit in Sheave Groove When Belt Is Bending Over Pulley
No Bulging against the sides of the sheave groove means that sidewall wear is evenly distributed over the full width of the sidewall—and that means much longer life for the belt!

The simple diagrams on the left show exactly why the ordinary, straight-sided V-Belt gets excessive wear along the *middle* of the sides. The diagrams show also why the Patented Concave Side greatly *lengthens the life* of the *sidewalls* of Gates Vulco Ropes. That is the simple reason why your Gates Vulco Ropes are giving you so much longer service than any straight-sided V-Belt can possibly give.

Saving SIDEWALL WEAR is more important NOW than ever before. ..

Now that Gates *SPECIALIZED* Research has resulted in Super Vulco Ropes capable of carrying much heavier loads—fully 40% higher horsepower ratings—the sidewall of the belt is called upon to do even more work in transmitting these heavier loads to the pulley. Naturally, with heavier loading on the sidewall, the life-prolonging Concave Side is more important now than ever before!

Gates

THE MARK OF SPECIALIZED RESEARCH

THE GATES RUBBER COMPANY *Denver, U. S. A.*

"The World's Largest Makers of V-Belts"

487

GATES VULCO ROPE DRIVES

Engineering Offices and Jobber Stocks IN ALL INDUSTRIAL CENTERS of the U. S. and 71 Foreign Countries

must depend largely upon their own observation and resourcefulness to acquire knowledge of the job and information regarding how the job may best be done. This lack of method is usually the most expensive method that could be employed. Under such conditions, time required by new employees to become thoroughly familiar with the work is much longer than where adequate instruction is given. Time lost and mistakes made, due to lack of proper preliminary instruction, cost more than the expense of providing some effective means of instruction.

It is better to ease a new employee into his job by conscientious guidance and supervision than to cause him to break his initial enthusiasm for the job through lack of suitable introductory and preparatory measures. It is the finest, yet cheapest, insurance for efficient workmanship.

Harry Kaufman
Philadelphia, Pa.

•

I am convinced that orientation is really worth the time and trouble and is far superior to the old policy of putting a new man right to work and expecting from him the same production as from the regular workers. Experience has proved that given a few days of adjustment, a good worker is soon able to show his ability and rapidly catches up to, or maybe surpasses, the performance of his fellow workers.

Al's method of breaking in a new man describes my viewpoint exactly. It gives the newcomer every chance in the world to get settled down and feel comfortable first, thereby speeding the transition from stranger to seasoned worker. In this way a new man is better able to take things in his stride. He adjusts himself to his new surroundings and work faster than if he were rushed into things without any briefing.

Too often a new man gets discouraged before he really has had an opportunity to feel his way, but Al's theory would prevent such a reaction. Improper handling or lack of friendliness and consideration have discouraged many a young fellow working away from home and have resulted in his throwing up the new job. A little cooperation on the part of his foreman and fellow workers, on the other hand, would help him get started on the right foot.

Labor turnover is an expensive item on a company's books, so a good foreman should be on the alert to find its cause. In the case of new employees, perhaps it is due to improper handling. Al's psychology is

"That conveyor drive breakdown will tie us up two weeks while we wait for parts . . ."
"Why wait?—you can make up a drive in a day or so using *stock* parts."
"Look at this catalog . . . it lists gears, speed reducers, flexible couplings . . . over 4000 stock items. You can make up any drive you need with this book!"
BOSTON
"This is a gold mine!"
"You bet it is — and Boston Gear products are tops in *quality*, too."
"What a break! . . . here are the very parts I need."
"With parts I can get from the local Boston Gear distributor, I'll have this conveyor running tomorrow."
"If you're a maintenance engineer, master mechanic or manufacturer, Boston Gear's great data book can help you lick breakdowns . . . cut 'down time' . . . reduce maintenance costs. Gives complete data on stock parts: sizes, dimensions, types, materials, etc. Distributors nearby. Fill your needs from one reliable source!"

FREE Put this 320 page data book to work earning for YOU!

101 separate groups of products—4326 individual items—engineered, mass produced to custom standards for your application. Also contains much valuable working data for designers, engineers, maintenance men.

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City..... Zone..... State.....

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62 distributors in major cities

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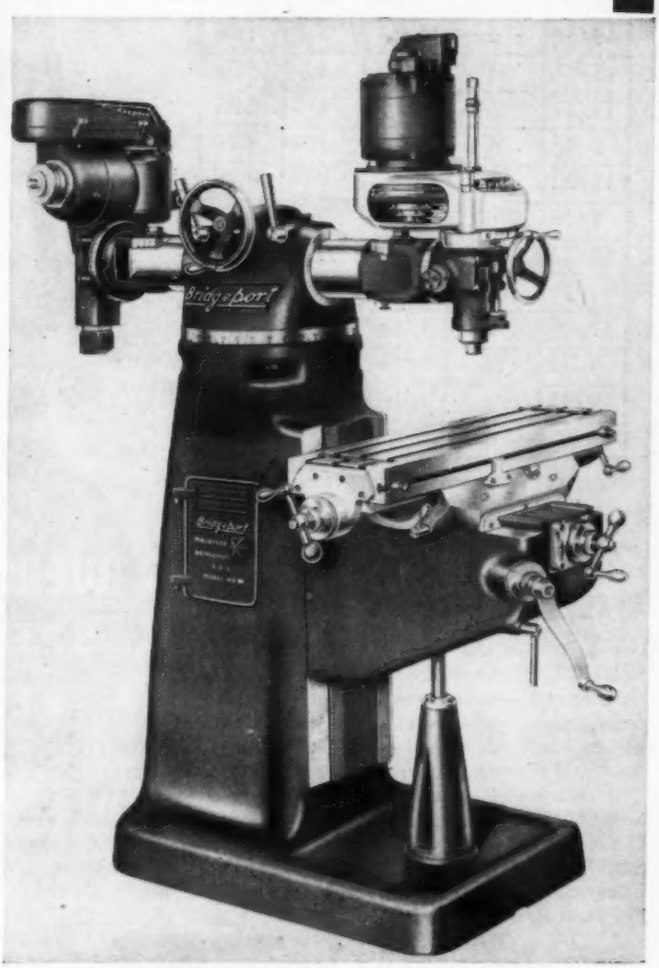
Bridgeport

TURRET MILLING MACHINE

Provides versatility to assure a high return on the investment



The 'Bridgeport' is a multi-purpose machine available at a moderate price, which, because of its ability to perform a wide range of operations accurately, can be kept busy on productive work. We believe an investigation of the operation of the more than 8,000 'Bridgeports' in service would show an above-the-average number of productive machine hours in daily performance.

It is to your advantage to determine the investment value of this machine on your work through the savings it effects in set up time and through ability to mill, drill, bore and shape at all angles of the work without changing set up.

Specifications

Longitudinal Feed	20" with standard table
Cross Feed	9"
Vertical Feed of Knee	16"
Standard Table	9" x 32"
Special Tables 36", 42" and 48" availab'e; also longitudinal power feed.	
Weight with Shaping Unit	2000 lb.

Bridgeport MACHINES, INC.
Bridgeport, Connecticut

New LOW PRICES on Carbide Tipped REAMERS

Check THESE LOW PRICES

Straight Shank — Straight Flutes

Diameter Inches	Number of Flutes	Shank Diameter Inches	Over-all Length Inches	PRICE
1/4	4	15/64	6	$3.75
9/32	4	15/64	6	4.00
5/16	4	9/32	6	4.00
11/32	4	9/32	6	4.25
3/8	4	5/16	7	4.25
13/32	4	5/16	7	4.75
7/16	4	3/8	7	4.75
15/32	4	3/8	7	5.00
1/2	6	7/16	8	5.50
17/32	6	7/16	8	5.75
9/16	6	7/16	8	5.75
19/32	6	7/16	8	6.25
5/8	6	9/16	9	6.25

Note: For taper shank requirements, use standard split sleeve reamer driver. Available at moderate price.

Now QUALITY Carbide Tipped REAMERS IN THE H.S.S. PRICE RANGE

WENDT-SONIS SPE-D-CUT REAMERS

Low prices on the new line of Wendt-Sonis SPE-D-CUT reamers are made possible by standardizing on straight shank styles and the size ranges most widely used. Tools are designed to highest standards with precision tolerances (.0005 on dia.) and diamond lapped cutting edges. All sizes carried in stock. Get increased production possible with SPE-D-CUT carbide reamers at an initial tool cost only slightly higher than H.S.S. WRITE today for catalog sheet on SPE-D-CUT reamers! WENDT-SONIS CO., Hannibal, Mo.—580 N. Prairie Ave., Hawthorne, Calif.—1361 W. Lake St., Chicago, Ill. Warehousing Facilities: Eastern Carbide Corp., 909 Main St., New Rochelle, N. Y.

WS

WENDT SONIS

CARBIDE CUTTING TOOLS

BORING TOOLS • CENTERS • COUNTERBORES • SPOTFACERS • CUT-OFF TOOLS
DRILLS • END MILLS • FLY CUTTERS • TOOL BITS • MILLING CUTTERS • REAMERS
ROLLER TURNING TOOLS • SPECIAL BITS

a good cure for that. However, where "old timers," who are an asset to the company, are involved, their quitting should be thoroughly investigated. Some grievance or dissatisfaction may be brought to light which rightly should be rooted out. The loss of good men is costly to a company and replacing them often proves costlier.

Arthur Silvester
Niantic, Conn.

•

Lack of proper orientation of all workers is one of the greatest mistakes made by management. It is not sufficient for the industrial relations or employment manager to bring the new man out into the shop and introduce him to a few foremen who might have contact with him. A planned program, in which the foreman is the key man, is necessary.

The old days of hiring a man and letting him learn the hard way have gone. Industry must learn to educate its employees. It must, by such things as proper orientation, instill in the workers a fellowship that will help to alleviate the intense unionism that exists today.

In the period of introduction, the employer, through his employment manager and his foreman, has the nucleus with which to train the employee in the ways of proper workmanship. Safety rules, working regulations and company policies can be easily taught. A new employee is interested in his job and in trying to learn how he can hold it. This does not mean that the company should ram down an employee's throat a lot of industrial propaganda to sell a one-sided story. Industry must be open and frank, admitting its shortcomings, yet offering a plan where all can benefit. Too frequently the employee does not have an opportunity to advance any ideas or discuss working problems before actually going to work.

This program of introductory orientation will make an employee feel that the company is interested in him as an individual and in his welfare. He will be more loyal and work for the interest of the company more readily than an employee that is hired and left to shift for himself.

In order to better understand how a successfull plan operates, the following is a plan that has been used with success by a medium-sized company:

Each prospective employee that the employment manager thinks has potential value is taken on a plant tour, conducted by either the em-

Enduring Precision

This spindle bearing is standard equipment on large spindles designed by a world-famous builder of precision grinders. For extreme accuracy, for freedom from vibration, and for enduring precision, only sleeve bearings will do. Where other types of bearing retain their accuracy only for months, Bunting Spindle Bearings endure for years. Where other complex types require a surgical standard of cleanliness and a watchmaker's skill for replacement, the Bunting Sleeve Bearing requires only common-sense and the services of a good mechanic.

The secret of this performance and long life lies in the film type of lubrication. A properly designed and well lubricated sleeve bearing need not acknowledge any superior. No other bearing type possesses its simplicity, its ruggedness, its ability to deliver accurate work for many years. These attributes are possessed by the sleeve bearing.

Bunting engineers are at your service whether your problem is a precision grinder spindle, an aircraft engine, an automobile engine, or something of more or of less exacting requirements. Bunting engineers utilize their extensive experience with bearings of all types in their work of designing Bunting Cast Bronze Sleeve Bearings. The Bunting Brass & Bronze Company, Toledo 9, Ohio. Branches in Principal Cities.

Bunting

BRONZE BEARINGS

PRECISION BRONZE BARS

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SHAPE-RITE
8" Stroke Hy-Duty Model
SHAPER

SHAPE-RITE—8" Stroke Hy-Duty Model Shaper

The 8" Hy-Duty Model Shaper, taking a full 8" cut, is unexcelled for tool and die makers and small instrument manufacturers.

SHAPE-RITE SHAPERS are engineered to provide faster set-ups . . . one of the most important elements for greater production.

Maximum versatility . . . controls within easy reach . . . and many other built-in features cut set-up time to a minimum and eliminate many costly jigs.

Furnished with plain or swiveled table, the SHAPE-RITE SHAPER provides fast economical operation. Investigate it now!

See your local dealer or write Dept. 148

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Noblewest
MODERN MARKING MACHINES

- speed production
- lower marking costs

The new Noblewest marking machines, such as Model 194, illustrated, represent the highest degree of development in production marking. Users report increases in marking speeds up to 500% with substantial reduction in production costs. To mark your products faster, better, cheaper, consult with Noblewest engineers. There's no obligation. Just write Noble & Westbrook Manufacturing Co., 17 Westbrook Street, East Hartford 8, Conn.

MARK IT BEST WITH NOBLEWEST IMPROVED MARKING DEVICES
NOBLEWEST

ployment manager or someone else equally qualified. A story of the product being manufactured and what goes on in each department is outlined as they progress through the plant. Certain key men who are available are introduced. The various office sections are also visited. This helps to broaden the prospective employee's knowledge of the company product and how the company functions. It assists the employee to make up his own mind as to whether or not he would be satisfied with such employment. His reactions as he tours the plant are observed and will assist the employment manager in the final decision.

Usually the supervisor of the department into which the prospective employee might go is called in to talk with the applicant. The foreman, who is to make the final decision on the man, is also asked to talk briefly with the jobseeker. After the man is signed up, the industrial relations dept. function is to see that the man is given the data on working rules, safety, and company policies. Here the foreman takes over. The new employee is more or less drilled in working rules as they affect him. He is shown how to work safely, and company policies as they affect him on the job are again stressed. The foreman makes a point to introduce him to the other workers who will have contact with him. He is introduced to the tool crib attendant and given an explanation of the tool check-out system. Rest rooms and working hours, smoking restrictions, etc. are talked over. The man is then put on the job and watched and guided by the foreman. He is taught the way to do certain jobs that have established work procedure methods. In this manner the employee learns how he can best serve the company and also advance himself.

The program outlined has undoubtedly contributed materially to a better relationship between employee and employer. While this plan has been effectively followed by a medium-sized company, it can be used equally effectively, with ramifications, in any size plant.

Charles D. Townsend
Centralia, Missouri

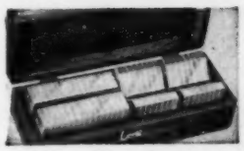
•

SWAPPING SHOPS?

I agree with Al's ideas on the exchange of men among firms doing similar business, in accordance with the regulations set up governing such swaps.

Such an arrangement opens up a practical way for a journeyman to

SCHERR *aids to precision – production*



Save time on Surface Grinders With SCHERR MAGNE-BLOX

When placed on magnetic chuck, these magnetism-conducting parallels and angle irons will firmly hold small pieces and irregular shaped work. *No need* of special clamps or fixtures. THEY RETURN THEIR COST many times over by quicker setups, more accurate results, less danger of distortion and bowing when grinding this flat work. Many different sizes and shapes. DON'T REGRIND YOUR MAGNETIC CHUCKS—BE WISE—USE MAGNE-BLOX—*Special Offer:* Set consisting of 2 parallels 1 x 1¾ x 3¾ plus 2 V-blocks, hard brass and Swedish iron laminations in solid metal case $17.50. Money back if you can duplicate this value.

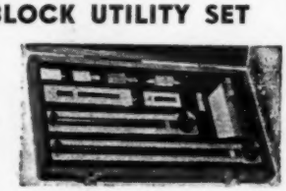
CUTTING TOOL GRINDING FIXTURE

FOR SURFACE GRINDER, grinds both cutting angle and clearance in one setting. The unique patented feature is a tilting block which gives 3, 5, 7, or 10 degrees clearance to the tool, just the right cutting angle to suit the material to be machined. This simple inexpensive tool does the work of special machines. Clamp the tool to be ground in the Scherr Fixture, set to angle desired and tilt the block to proper clearance. Special introductory price $27.50, with Scherr money back guarantee.

LITTLE WONDER RADIUS DRESSER

Dresses wheels on surface of cylindrical grinders to any desired radius up to 1", concave or convex. The swinging arm, the only moving part of this ingenious simple device, is pivoted on two lapped centers which never freeze or clog. Supported on both ends with no overhang or slides, there can be *no vibration of the diamond.* Result: absolutely smooth and accurate radii on the wheel. The Diamond tool is set by means of Micrometers, Depth Gages or gage blocks. Price complete with 1/3 carat diamond $46.00—$39.00 without.

GAGE BLOCK UTILITY SET



Quick adjustable type holders. Greatly expands the usefulness of any set of standard gage blocks. The complete set includes four holders — 2", 4", 8" and 12", two jaws each for inside and outside measurements, a 60 deg., center point, a scriber point, and a substantial height gage base. Holders have no long projecting screws to make handling awkward. Every shop can profitably use one or more of these economically-priced sets, which will save their cost many times over by applying gage block accuracy at first hand, allowing for no variation through the use of any other tool. Any parts of this set can be furnished separately at moderate cost. Set, $98.50.

Write for the Scherr Small Tool Catalog with full details on these tools

GEO. SCHERR CO., Inc.
270-D Lafayette St. New York 12, N. Y.

broaden his knowledge and experience and prevents hi mfrom getting into a rut on his regular job.

When I finished my apprenticeship, I was laid off and went to work in various shops. But in a few years, I was asked to return to the old shop. This was standard practice there and was applied to all its graduates. Today, such a procedure is not so workable because of the problems posed by job seniority and job security.

I firmly believe that any worker or firm can benefit by a plan such as Al's for it offers the opportunity to exchange knowledge, stimulates new ideas and perhaps improvements on old ones. In giving the worker the chance to see what's going on in other companies, it may open his eyes to the desirability of his regular shop ,and in that sense become a morale builder.

I have seen all this work and understand the real meaning of being a journeyman in my trade. But I always feel that we can, if we will, learn from others.

Albert E. Lyon
Waterbury, Conn.

•

In recent years increasing attention has been given to the use of transfers within the organiaztion to maintain the interest of the employees and overcome monotony. Swapping jobs in the plant could easily be extended to swapping jobs between shops, with equal, if not greater, benefits accruing to both men and management. Due to the increasing division of labor and specialization, many jobs have attained a simplicity that has become highly monotonous and, for that reason, objectionable to certain types of workers. One means of allaying dissatisfaction is in the use of transfers of workers between shops. The effect on employee morale is a major criterion by which the practice may be judged.

Worker interest may be aroused by the possibility of satisfying a craving for the new, untried, and novel, or by appeals to mechanical propensities or other elementary driving forces. Through the temporary change of shops, the worker's mechanical activities will have a new and perhaps more fertile field for expression. New ideas for improvement and development of mechanical ability will certainly make him a more valuable employee to the parent organization.

By having an agreement between the firms entering into the transfer arrangements, whereby no man can go to work for the other concern for at least six months after his ex-

"Good Cutting Oils Sure Keep You Out of Trouble"

...says
"CHIP" WRIGHT

"Whenever there's trouble with tools or finishes or jobs fall behind schedule, the first thing I check is the cutting fluid, because when that's not exactly right, it's surprising how it can upset the whole job. You just can't get around it, cutting oils do make a big difference . . . and it isn't smart to quit trying until you find the right one. It doesn't make sense to put up with headaches that can be avoided. That's why I think it pays to rely on experienced cutting oil people. They come up with sound, practical assistance."

Here's a Practical Tip:

For Your *Toughest* Jobs Try THREDKUT

You've heard of THREDKUT and what it has accomplished on tough jobs where other oils have failed. The stabilized balance between its uniformly high anti-weld value and its other desirable cutting characteristics, make it especially efficient in the machining of tough, stringy metals . . . and for the more difficult operations such as thread cutting, tapping, broaching and gear shaping. Here's a cutting fluid that can help you. For complete information, write for the THREDKUT Booklet.

Another Time-Tested Stuart Product

STUART *oil engineering goes with every barrel*

D.A. Stuart Oil Co.
EST. 1865 LIMITED

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change period has expired, the danger of the temporary transfer becoming permanent is largely eliminated.

A first step in such transfer arrangements should be a clearcut statement of policy by management respecting the transfers. It should indicate that no man has to accept such a transfer if he is unwilling to make the temporary change.

In swapping shops, consideration should be given to the apparent habits and temperament of the men selected, so that those whose attitudes and interests are obviously unsuited to a change of industrial environment are not transferred.

Workers who have initiative will welcome the opportunity to use it under new conditions, and will not be forced into a situation where their continuation in routine operations will lead to dissatisfaction, with resulting poor levels of performance. Swapping shops has unlimited possibilities for job adjustment and will tend to reduce monotony and increase interest. It is well worth encouragement and further development by management and labor.

Harry Kaufman
Philadelphia, Pa.

I believe men can be broadened by a temporary exchange. One month is a very short time to get acquainted with the location of the lockerroom, time clock and the tool crib, let alone available equipment, tools, and procedures. Before men will show a new man the ropes or teach him new tricks, the latter will have to gain their confidence.

Unfortunately, I am not familiar with any such swap agreements, but have worked in a plant where it was necessary to send men out to set up special machinery. One fellow always came back praising the other plant, the equipment, rate of pay, industrial relations, etc., but stayed on with his own firm. Another fellow was always glad to get back and would knock the other plant. These trips were usually out of state and ran from six to eight months.

Frankly, we boys never learned anything from these travelers, except what hotel they stayed at, where they ate ,and what shows they saw. This put some glamour into the job, but they weren't too anxious to leave. In short, the man gets the benefit of the swap, not the company.

Frank J. Zarnowski
Rutherford, N. J.

M & N HYDRAULIC HOBBING PRESS

Capacities to 1,000 Tons

- **Lower Costs**
- **Self-Contained**
- **Sturdily Built**
- **Prompt Delivery**

Also adapted to Blanking, Forming, Embossing, Hobbing

Prompt response—with absolute control of moving parts for precision blanking, forming, drawing, embossing, shearing, and other uses.

The M & N Hobbing Press is delivered ready-to-operate—simply hook the electrical connection to your power line. Completely self-contained, this sturdily built press requires a minimum of floor space.

Special M & N Hobbing Presses can be built to your specifications. Write for our new, illustrated catalog on standard M & N hydraulic equipment.

M & N Machine Tool Works, Inc.
152 Orono Street Clifton, N. J.

from FLAT SURFACES TO INTRICATE SHAPES with the New DI-ACRO BRAKE

- ROK-LOK—new sensitive material clamp increases accuracy
- DOUBLE-EDGED FORMING BLADE allows close reverse bends
- NEW PRECISION STOPS accurately control angularity of bends

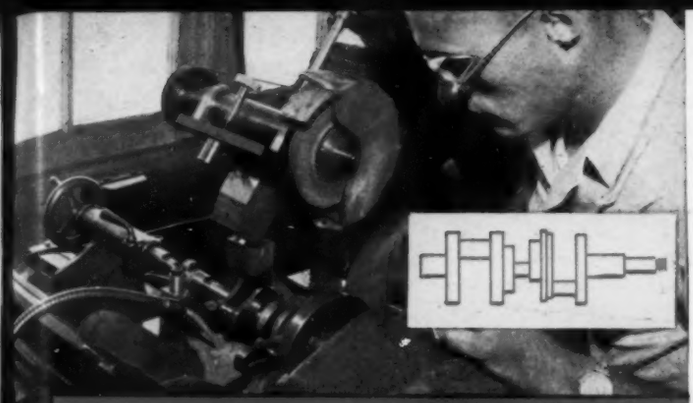
This versatile metal forming machine was developed for use in model shops, experimental laboratories and production departments where it often replaces dies for all types of precision forming operations. Di-Acro Brakes will form a great variety of materials including bronze, stainless steel, aluminum and bi-metals.

WRITE FOR CATALOG. New edition of 40-page Di-Acro Catalog contains detailed information on all Di-Acro Brakes, Shears, Notchers, Rod Parters, Benders, and Punches and illustrates how these precision machines can be used individually or cooperatively for "DIE-LESS DUPLICATING".

◀ Di-ACRO is Pronounced "Die-Ack-Ro"

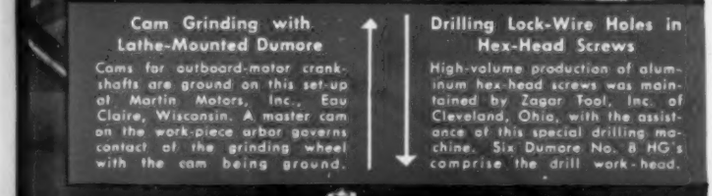
DI-ACRO PRECISION MACHINES DIE-LESS DUPLICATING

O'NEIL-IRWIN MFG. CO.
8TH AVE., LAKE CITY, MINNESOTA



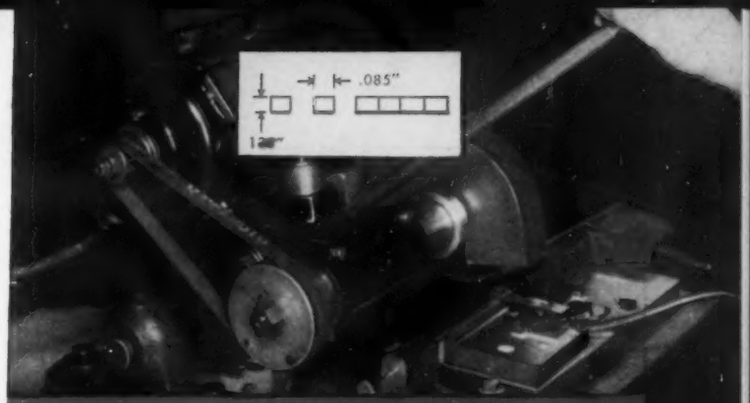
Cam Grinding with Lathe-Mounted Dumore

Cams for outboard-motor crankshafts are ground on this set-up at Martin Motors, Inc., Eau Claire, Wisconsin. A master cam on the work-piece arbor governs contact of the grinding wheel with the cam being ground.



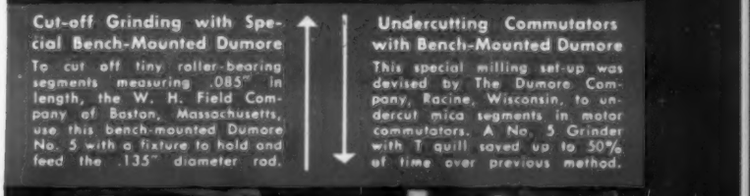
Drilling Lock-Wire Holes in Hex-Head Screws

High-volume production of aluminum hex-head screws was maintained by Zagar Tool, Inc. of Cleveland, Ohio, with the assistance of this special drilling machine. Six Dumore No. 8 HG's comprise the drill work-head.



Cut-off Grinding with Special Bench-Mounted Dumore

To cut off tiny roller-bearing segments measuring .085" in length, the W. H. Field Company of Boston, Massachusetts, use this bench-mounted Dumore No. 5 with a fixture to hold and feed the .135" diameter rod.



Undercutting Commutators with Bench-Mounted Dumore

This special milling set-up was devised by The Dumore Company, Racine, Wisconsin, to undercut mica segments in motor commutators. A No. 5 Grinder with T quill saved up to 50% of time over previous method.

*All in the day's work for a Dumore**

he tool that does more for you...

rinding, drilling, and light milling...*at lower cost*

*Trade Mark Reg. U. S. Pat. Off.

The Dumore is well named! It's the tool that *does more* — more and more every day. First famous as a toolroom grinder, the Dumore is so adaptable, it has become a universal shop-tool today.

Yes — you can really do more with a Dumore! *You can do more with your present machines;* a Dumore converts standard tools or used tool-bases into precision grinders. *You can do more with special equipment you build yourself;* a Dumore is a versatile work-head adaptable to almost any job. *You can do more kinds of work;* a Dumore does external, internal, surface, tool, and thread grinding — plus drilling and light milling.

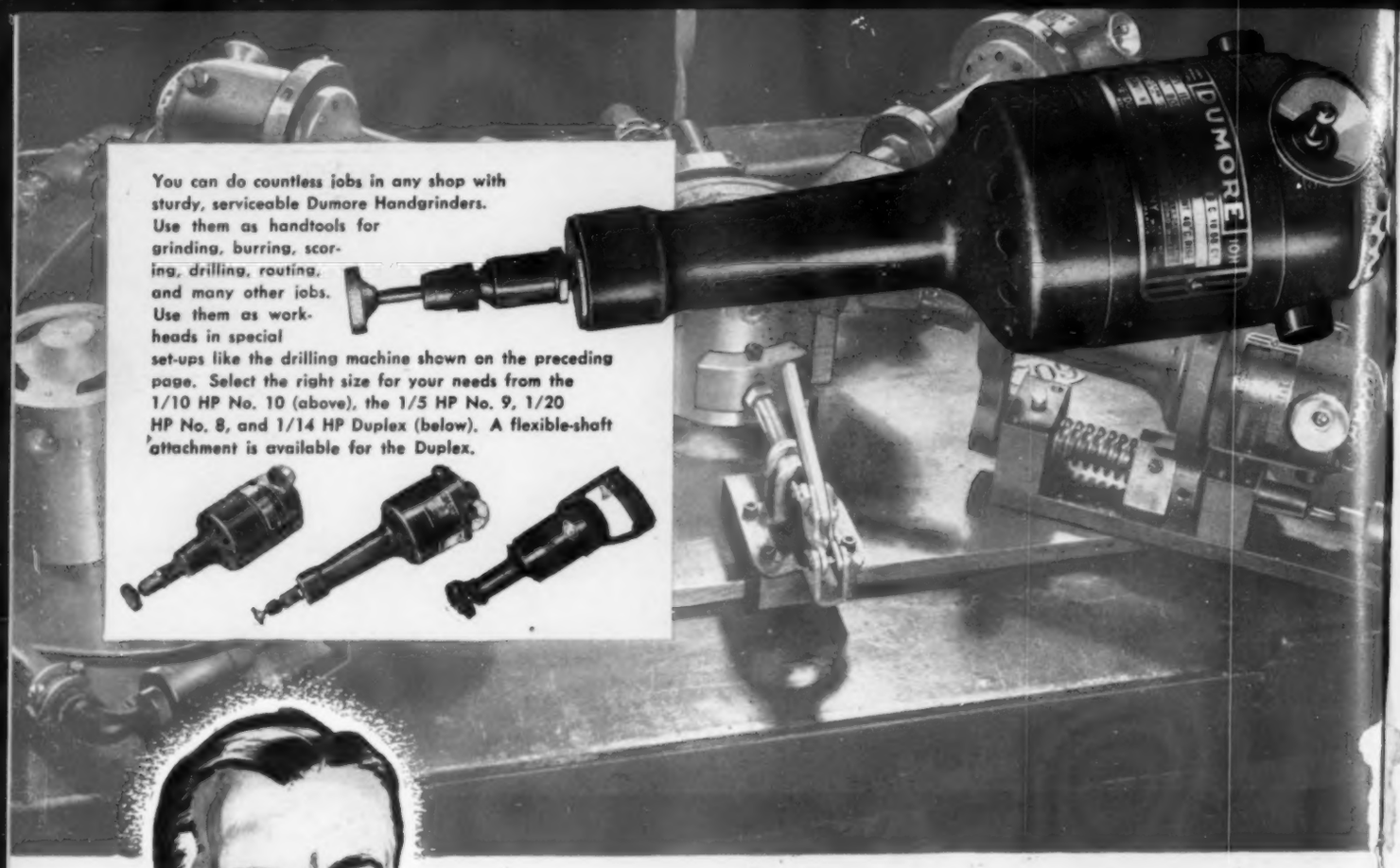
Plan to *do more with a Dumore!* Your distributor can help you avoid investment in expensive equipment, with planned Dumore set-ups. Ask him to specify the Dumores for your special requirements. There are 7 models with interchangeable quills, for internal grinding to 24" depths, and speeds up to 42,500 rpm, for work to ± .0001" accuracy! And don't overlook dependable Dumore Hand-grinders — for more *adaptability that does more for you!*

DUMORE

RACINE, WISCONSIN

Sold by leading industrial distributors in all principal cities

Turn the page for information on other Dumore Tools ——→



You can do countless jobs in any shop with sturdy, serviceable Dumore Handgrinders. Use them as handtools for grinding, burring, scoring, drilling, routing, and many other jobs. Use them as workheads in special set-ups like the drilling machine shown on the preceding page. Select the right size for your needs from the 1/10 HP No. 10 (above), the 1/5 HP No. 9, 1/20 HP No. 8, and 1/14 HP Duplex (below). A flexible-shaft attachment is available for the Duplex.

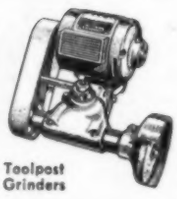
Your Dumore Distributor knows how *cut your costs* with Dumore* Tool

You can do more with a Dumore—and your distributor knows how. He is an expert on the Dumore line. He has a file of information showing how countless other companies have saved with Dumore. He maintains a complete stock of the Dumore line to give you prompt delivery and service.

Yes—it's easy to cut toolroom, maintenance, and production costs—with Dumore! Take advantage of your distributor's special experience. Let him explain the cost-cutting possibilities of the entire Dumore line—the seven different Toolpost Grinders, 35 Quills, 4 Handgrinders, high-speed Bench-Drill, Drill Speeder attachment for standard drill presses, and Flexible Shaft Tool — the Dumore Tools that do *more* for you by cutting your plant-wide costs.

Suggestions from Dumore distributors save money for manufacturers every day. They can do the same for you. *Do more with Dumore.* Call your distributor today!

*Trade Mark Reg. U. S. Pat. Off.


Toolpost Grinders

Dumore Quills

Handgrinders

Drill-Speeder

High-Speed Drill Press

Flex Shaft

Turn the page for special information on cost-cutting Dumore Grinders

tear out this coupon and mail today!

The Dumore Company, Dept. G-14, Racine, Wisconsin

Please send me complete information on:

☐ Toolpost Grinders ☐ Handgrinders ☐ Drill-Speeder
☐ Quills ☐ Drill Press ☐ Flexible Shaft Tool

Name.....

Company.....

Address.....

City.....(.....) State.....

RACINE, WISCONSIN

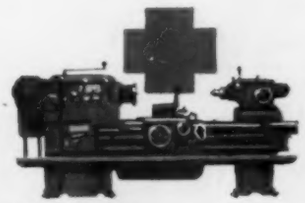
Sold by leading industrial distributors in all principal cities

AXELSON FIRST CHOICE

MASTER MACHINISTS AGREE... there is no finer engine lathe than an AXELSON. Designed by men who are themselves master toolmakers, AXELSON lathes embody every feature that contributes to faster production, more accurate work, easier and safer operation, and maximum versatility.

THE "FEEL" OF PERFECTION... is immediately apparent the first time a machinist puts the tool to the work in an AXELSON lathe. Velvet smooth control action... Continuous flow of power at the cutting tool without vibration or chatter.

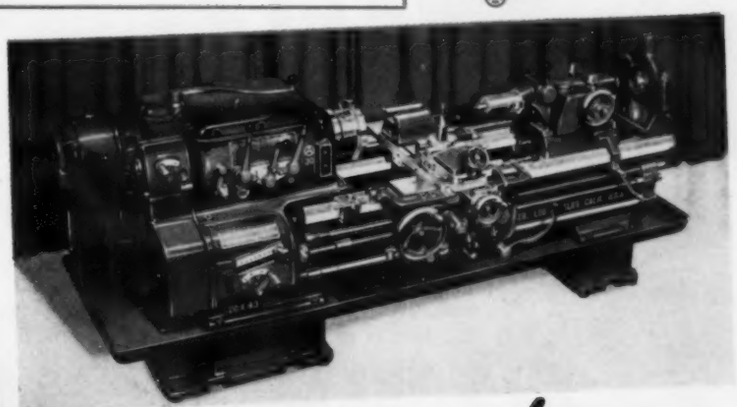
THE TOOL CARRIES THROUGH... with precision accuracy from the beginning to the end of each cut. Massive construction throughout to maintain absolute alignment... Perfectly mated bearing surfaces on slides and ways... Heavy duty anti-friction bearings... Hardened and ground alloy steel gears... Rugged headstock, apron, tailstock, and gear cases.



BUILT-IN SAFETY... protects operator from injury, tools from breakage, and work from the reject bin. Handwheels, levers, and other controls located within easy sight and reach of operator... Extreme rigidity and absence of backlash protect costly cutting tools... Positive automatic force-feed lubrication to gears, bearings and ways preserves original precision accuracy.

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

PRACTICAL VERSATILITY... permits a wide variety of operations with all types of tools, on any kind of stock... Two-speed tailstock... Wide range of feeds and speeds instantly available... Ram type turret, power rapid traverse, micrometer carriage stops, relieving and taper attachments, and many other accessories available for added versatility.



AXELSON *Lathes*

DEPENDABLE FOR A THIRD OF A CENTURY

AXELSON MANUFACTURING CO.

LOS ANGELES 11 • NEW YORK 7 • ST. LOUIS 16

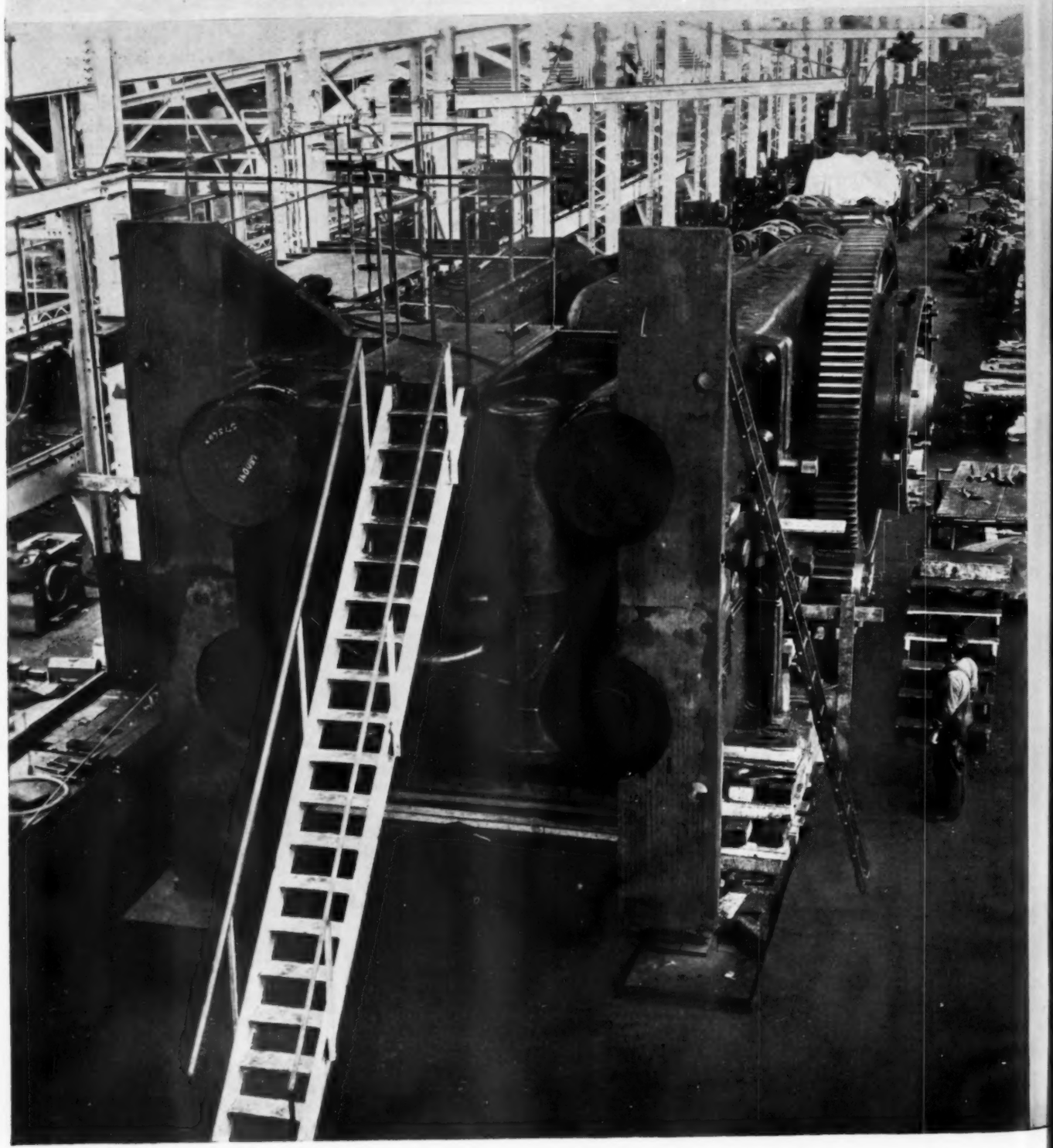
Authorized Distributors in All Principal Industrial Centers

FREE

TO PLANT EXECUTIVES

Complete illustrated descriptive literature tells the story of Axelson's Lathes. Write today on your company's stationery.

MEET GARGANTUA



-of the forging world!

National pioneering and engineering have placed the world's largest mechanical forging press at the command of American industry!

This giant No. 10 High Speed Maxipres, which will mass forge automobile engine crankshafts, now makes possible the forging of large parts for equipment used in such industries as railways, earth moving, mining, petroleum, and many other heretofore not within the capacity of mechanical forging presses.

The colossal strength and rigidity of this press holds work to extremely close tolerances, with freedom from draft and a minimum of flash. Result—a substantial savings of material and reduced machining. Also, production is increased and a less skilled operator is required.

If you are forging or plan to forge large parts, why not investigate the possibility of the No. 10 Maxipres?

Quick facts regarding National No. 10 Maxipres

Height: 33 feet 6 inches
Weight: 1,600,000 lbs. (equal to the combined weight of 10,000 men!)
Speed: 40 strokes per minute

Capacity: Will produce at one blow in each die impression the size of work normally handled on a 12,000-pound steam hammer.

NATIONAL
MACHINERY COMPANY
TIFFIN, OHIO.

DESIGNERS AND BUILDERS OF
MODERN FORGING MACHINES—MAXIPRESSES—COLD HEADERS—AND BOLT, NUT, RIVET AND WIRE NAIL MACHINERY

New York Detroit Chicago

Tests prove them 3 to 10 times better

Gorham

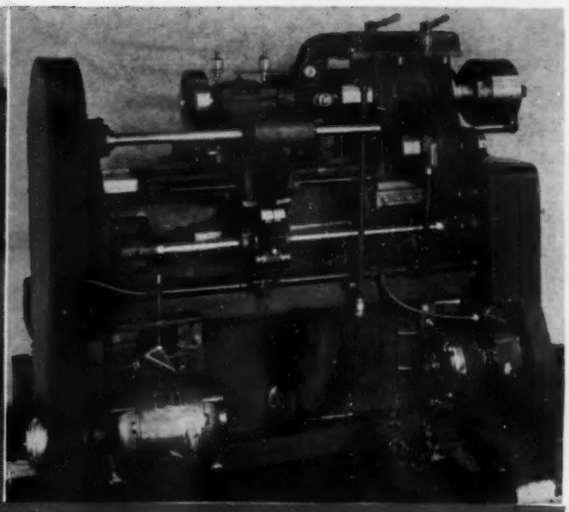
M-40-U ALLOY CENTERS

GORHAM "M-40-U" is a special alloy developed by the Gorham Tool Company expressly for use as a wear and abrasion resistant metal. So superior is this alloy that by *actual test* it has shown results 3 to 10 times better than high speed steel and other alloy materials for centers. Standard M-40-U alloy tipped centers can be furnished from stock. ★ ★ ★ Special M-40-U Alloy centers can be furnished to your specifications, or our engineering department will assist you in the design of special centers to meet your needs. Choose GORHAM "M-40-U" for top performance and long wear.

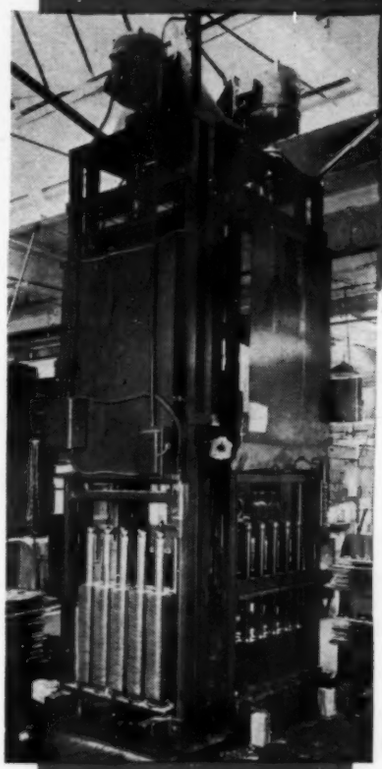
GORHAM TOOL COMPANY

14400 WOODROW WILSON DETROIT, MICH.

For High Production—four 5 horsepower Squirrel Cage motors operate milling machines



Accurate Thread Cutting—One horsepower and a two horsepower Squirrel Cage motor drive this thread cutting lathe



Three 7½ HP "Frequent Reversing" (rated 10 times per minute) Squirrel Cage motors drive an assembly press.

Century

Engineered Motor Applications

Accurately Meet Your Load Requirements—Assure Long Motor Life—Dependable Service

Century builds properly engineered motors to meet the requirements of all popular machine tool and other industrial equipment.

They are ruggedly constructed to assure a long life of continuous, economical service—built with the stamina to keep your production machinery in operation day after day.

Century motors have the following advantages—unusual freedom from mechanical and electrical vibration, rigid frame and end bracket construction, adequate ventilation system, accurate machining.

Century builds a wide range of motor types, in sizes from 1/6 to 400 horsepower to assure top performance.

Specify Century for all your electric power requirements.

CENTURY ELECTRIC COMPANY

1806 Pine Street,
St. Louis 3, Mo.

Offices and Stock Points in Principal Cities

572

Century C MOTORS

Able Helmsmen Needed-

WITH our way of life threatened and even our motives for helping others discredited, we drift toward destruction of the very thing that makes America the envy of the world --individual liberty. Who can steer our course, to save our craft from wreck?

It is *your* job. You, as a leader in your community, must help arouse public opinion to a full appreciation of America's sacred heritage of freedom for the individual. You owe it to yourself, your family, your neighbor and your nation, to give of your experience and knowledge to pilot us safe through the storm.

These tempestuous times demand the intelligent work of leaders in every community to preserve America as the impregnable vessel of liberty and freedom. Here then, is important work for able helmsmen.

The Youngstown Sheet and Tube Company

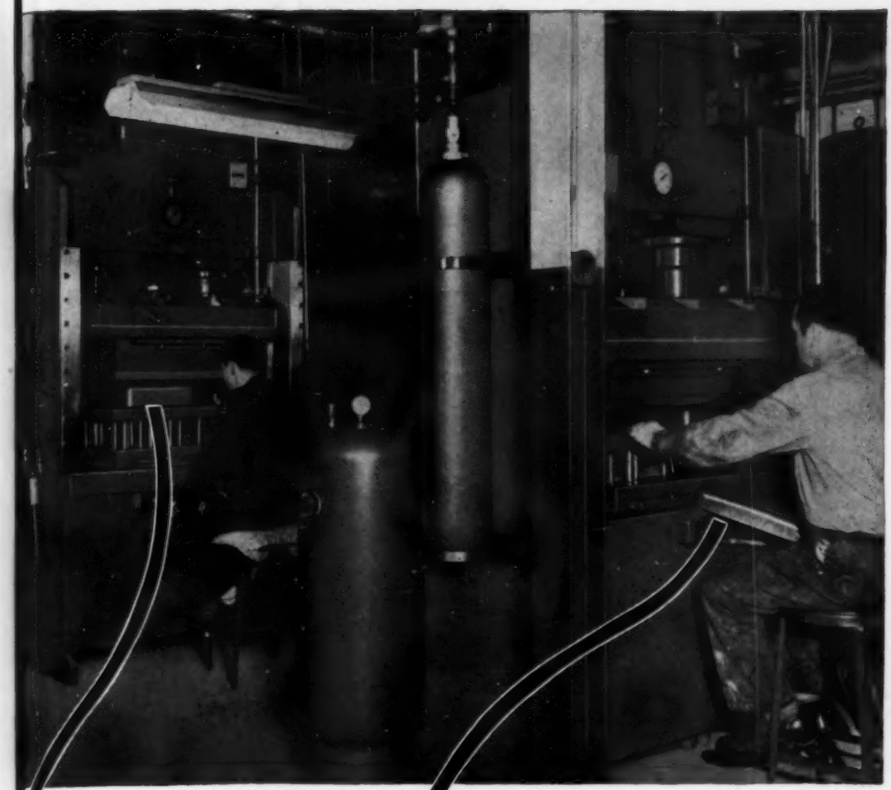
General Offices -- Youngstown 1, Ohio
Export Offices--500 Fifth Avenue, New York

MANUFACTURERS OF CARBON, ALLOY AND YOLOY STEELS

COLD FINISHED CARBON AND ALLOY BARS - SHEETS - PLATES - WIRE - TIE PLATES AND SPIKES - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - PIPE AND TUBULAR PRODUCTS - CONDUIT - BARS - RODS.

WE BUILD PRESSES FOR THE JOB NOT BY THE TON"

...K. R. Wilson



Union Steel Chest uses KRW Presses to do the work of heavier, more expensive equipment . . . Do it as fast, at greatly

Reduced Cost!

● Many a KRW Press user discovered long ago that a large percentage of forming, drawing and stamping work does not require the use of large, heavy-tonnage presses with their accompanying high initial and operating cost. Union Steel Chest of LeRoy, N. Y. is excellent proof of this statement.

Production records, in a variety of industries, show that KRW Presses greatly reduce costs. First investment is very low, operating costs are still lower. In one instance, the purchase price of a KRW Stamping Press was less than the foundation cost for heavier equipment.

KRW Presses are highly flexible...they can be built in varying bed lengths. KRW Presses are available as either Gap, Open End or Closed End Types. Tonnage pressures vary from 25 to 100 tons. Because they are hydraulically operated and not mechanically driven, they are quiet and vibrationless in operation. Platens can be stopped and reversed at any point in their travel.

Let us know your needs...we are fully equipped to engineer our equipment to handle your work. In the majority of cases, we can make delivery in a fraction of the time required for other type presses. Let us hear from you.

ALL TYPES OF DIES. We are equipped to engineer and build dies to meet your specifications. All we need is available technical data, blueprints and, where practical, a sample piece of work. We'll quote prices and delivery date.

● *Illustrated are two KRW 100-ton presses in plant of Union Steel Chest Corp., LeRoy, N. Y. making 3 and 4 inch draws for top and bottom sections of utility box shown on left.*

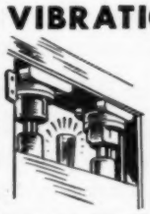
QUIET...

IT WOULDN'T WAKE A BABY. Easy, even hydraulic pressure does the work. No jarring impact as the die bottoms. No shock to the worker to lessen efficiency.

EFLECTION NIL...

NO SWAYBACK PLATENS TO WORRY ABOUT. Where pressures require it, bed rails, platens and head are trussed and ribbed to eliminate deflection.

VIBRATIONLESS...



GLASS OF WATER ON THE PLATEN, YOU'LL NEVER SPILL A DROP. That's how evenly pressures are distributed over the unit. That too, is another reason why dies last longer in a KRW.

NAME YOUR NEEDS...WE'LL QUOTE PRICE AND QUICK-DELIVERY DATE...MAIL TODAY

K·R·WILSON

215 MAIN ST. · BUFFALO 3, N. Y.

K. R. WILSON, 215 Main St., Buffalo 3, N. Y.

Please Send me complete information on new KRW 100-ton Hydraulic Presses.

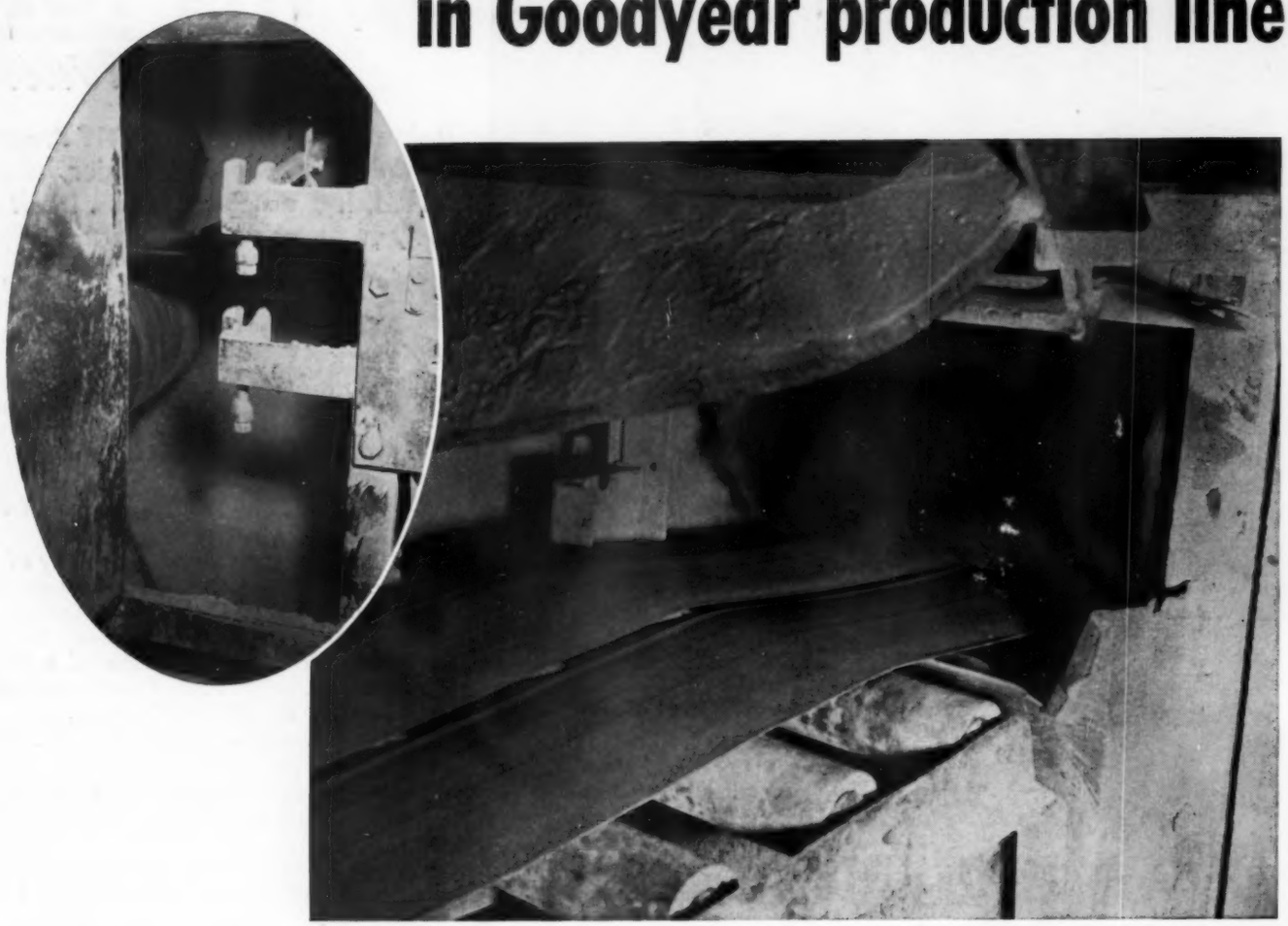
Name .....

Address .....

City and Zone ..... State .....

11

OSBORN BRUSHES serve as powder puffs in Goodyear production line



INDUSTRIAL powder puffs—that's the function of these Osborn power driven rotary brushes at the Goodyear Tire & Rubber Company, Akron, O.

As the uncured tire stock leaves the extrusion machines, a soapstone talc is blown on both sides of its "tacky" surface (note inset) to permit material to be stacked and handled without sticking. But application by blowing alone results in both spotty coverage and waste of soapstone.

And that's where Osborn Brushes take over. Acting as giant powder puffs, these horsehair rotary brushes (shown in main illustration) spread a thin, uniform layer of soapstone over the entire surface and remove the excess which is salvaged for later use.

Brushes formerly used for this job had a wood core which was subject to splitting and warping. The Osborn Brush with a steel center section eliminates these difficulties, permits a more uniformly filled surface of just the right stiffness and fullness to give a uniform spreading action.

Whether it is a cleaning, finishing, roughing or polishing operation, the right brush properly applied can save you time and money. Let an Osborn sales engineer show you how power driven brushes can be installed in your production line—at a profit. For complete information, write—

Osborn Brushes

THE OSBORN MANUFACTURING COMPANY

5401 Hamilton Avenue *Cleveland, Ohio*

WORLD'S LARGEST MANUFACTURER OF BRUSHES FOR INDUSTRY • POWER DRIVEN BRUSHES • PAINT BRUSHES • MAINTENANCE BRUSHES

Less Down-Time . . . Lower Costs

ON THE WORLD'S FASTEST PRODUCTION LINES!

DEFIANCE

PRODUCTION DRILLS

Designed to meet production requirements of one of the nation's largest automotive plants, Defiance Production Drilling Machines are built with *extra ruggedness* that means *less down-time . . . lower costs!* They're time-proven . . . for 18 years in high production work. *Extra dependability* in these Defiance features . . . anti-friction bearings on spindle and all speed shafts . . . alloy steel spindles and gears . . . wide choice of feeds and speeds . . . quickly adaptable to changes in production when needed . . . unbeatable for long-life low-cost operation on the production line.

MANY USES

Nearly 1000 Defiance Production Drilling Machines now serving industry in uses that include—

—*Automobile Plants* for single spindle drilling, reaming and tapping as well as multiple spindle work with special heads. Operations are on axle parts, gears, steering arms, differential case and cover, etc.

—*Diesel Engine Plants* for counterboring operation on cylinder bores and multiple spindle head operations on parts.

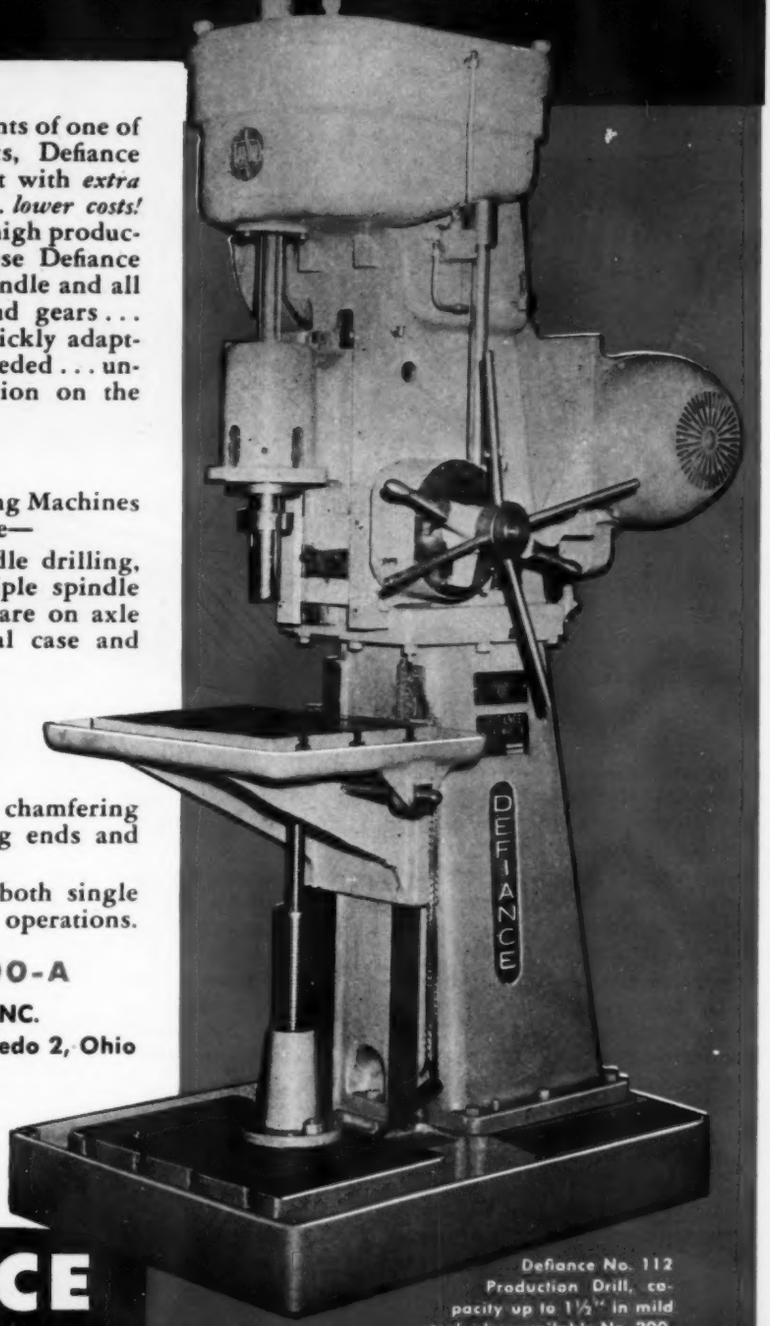
—*Refrigeration Manufacturers* for chamfering operation on cylinder bores, for facing ends and finish boring the bearing bosses, etc.

—*Machine Parts Manufacturers* for both single spindle and multiple spindle drilling operations.

WRITE FOR BULLETIN 100-A

DEFIANCE MACHINE WORKS, INC.

2325 Madison Ave. **Toledo 2, Ohio**



Defiance No. 112 Production Drill, capacity up to 1½" in mild steel; also available No. 200, capacity up to 2" in mild steel.

98 YEARS OF PRECISION MANUFACTURING

DEFIANCE

BORING . . . MILLING . . . DRILLING . . . TAPPING MACHINES

Adequate lubrication may be the answer to that problem draw. And Bonderizing may be the way to get it, because Bonderizing has an amazing affinity for oil, holding it tenaciously under high pressures.

Bonderizing's lubricant-holding power is one of the important reasons why seamless steel tube mills almost without exception, and many other manufacturers, use it as an aid in drawing.

Bonderite crystals supply a cushion between work and tools. Nonmetallic Bonderizing acts as an anti-flux to reduce galling and scoring. In many exacting draws, Bonderizing permits faster, smoother operation, fewer rejects, less wear on expensive dies.

Bonderizing as an aid in drawing may save *you* time, money, and tools! Write for technical bulletin containing complete information today!

Check these 8 ways Bonderizing aids drawing:

1 Provides positive lubrication and permits use of a wider range of lubricants.

2 Permits deeper draws.

3 Reduces material breakage and rejects.

4 Reduces metal-to-metal contact.

5 Prolongs tool life.

6 Allows wider variation in steel composition and heat treatment.

7 Reduces number of process anneals.

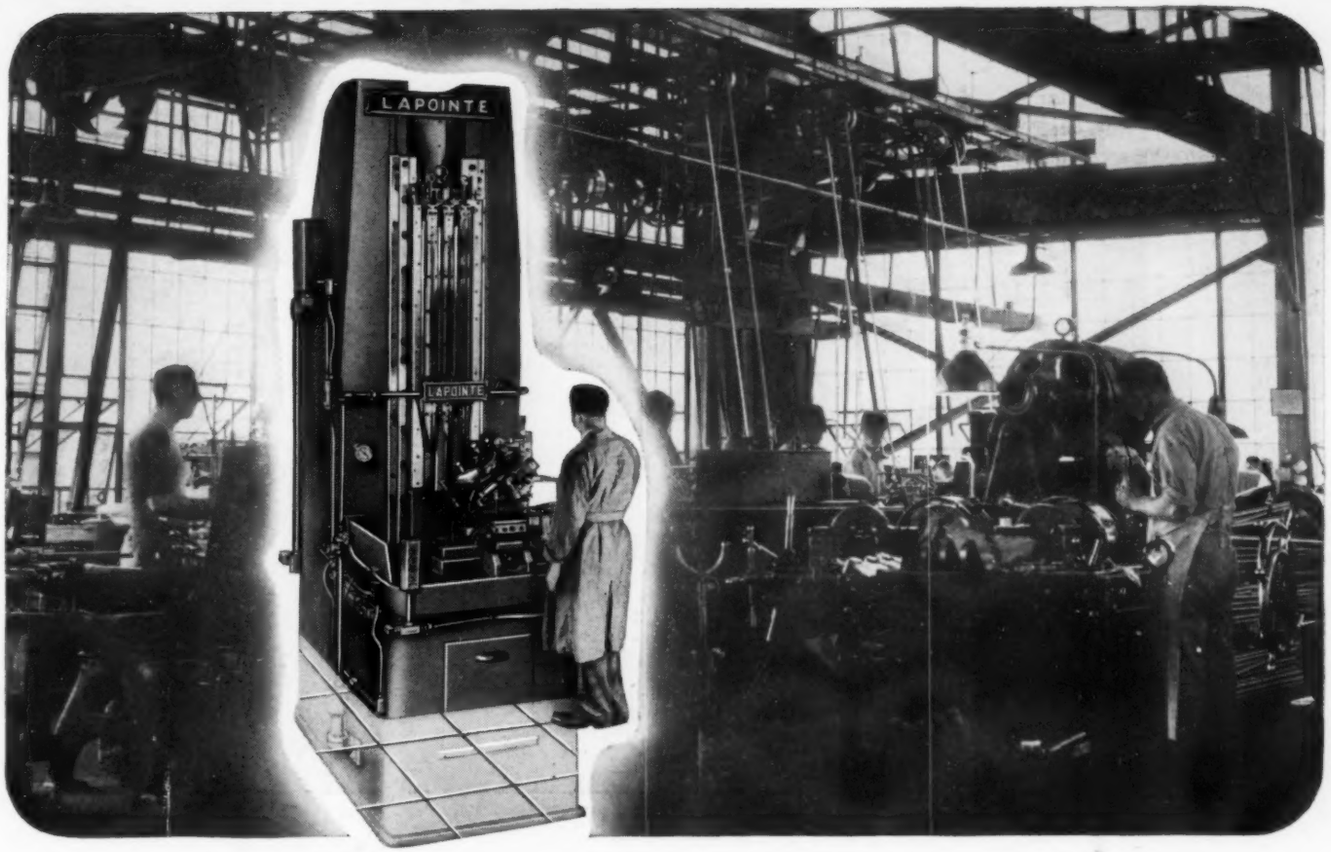
8 Gives smoother finish to final drawn product.

Bonderite, Parco, Parco Lubrite—Reg. U.S. Pat. Off.

PARKER

PARKER RUST PROOF COMPANY
2196 East Milwaukee Ave.
Detroit 11, Michigan

BONDERIZING Holds Paint to Metal . . . PARKERIZING Inhibits Rust . . . PARCO LUBRIZING Retards Wear on Friction Surfaces



What are *You* getting for today's high costs

Obsolete machinery operated at today's wage scales, costs you *more* than amortizing investment in the right modern production equipment.

Recently, Lapointe engineers replaced 6 obsolete machines with 1 Lapointe Broaching Machine. The pleased manufacturer cut his metal Removing costs to the bone. Close tolerances obtainable by Broaching also improved the quality of his product.

If METAL REMOVING is one of your production processes, Lapointe Broaching equipment more than pays its way by lowering your unit costs. It eliminates needless operations. It speeds your output. It cuts wasted high-wage man-hours in your Metal Removing. And it improves your quality.

The same dollars that each obsolete machine in your factory *throws away every man-hour* could be paying you dividends by lowering production costs. The smaller your backlog of unfilled orders, the more you need the low-cost modern production economy that is more vital every day in getting new business.

One of our engineers will be glad to visit your plant by appointment, to recommend definite ways to cut your individual Metal Removing Costs.

THE *Lapointe*

MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS • U. S. A.

Branch Factory • Edgware • Middlesex • England

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHES AND BROACHING MACHINES

THE LAPOINTE MACHINE TOOL CO.
20 Tower Street, Hudson, Mass., U.S.A.

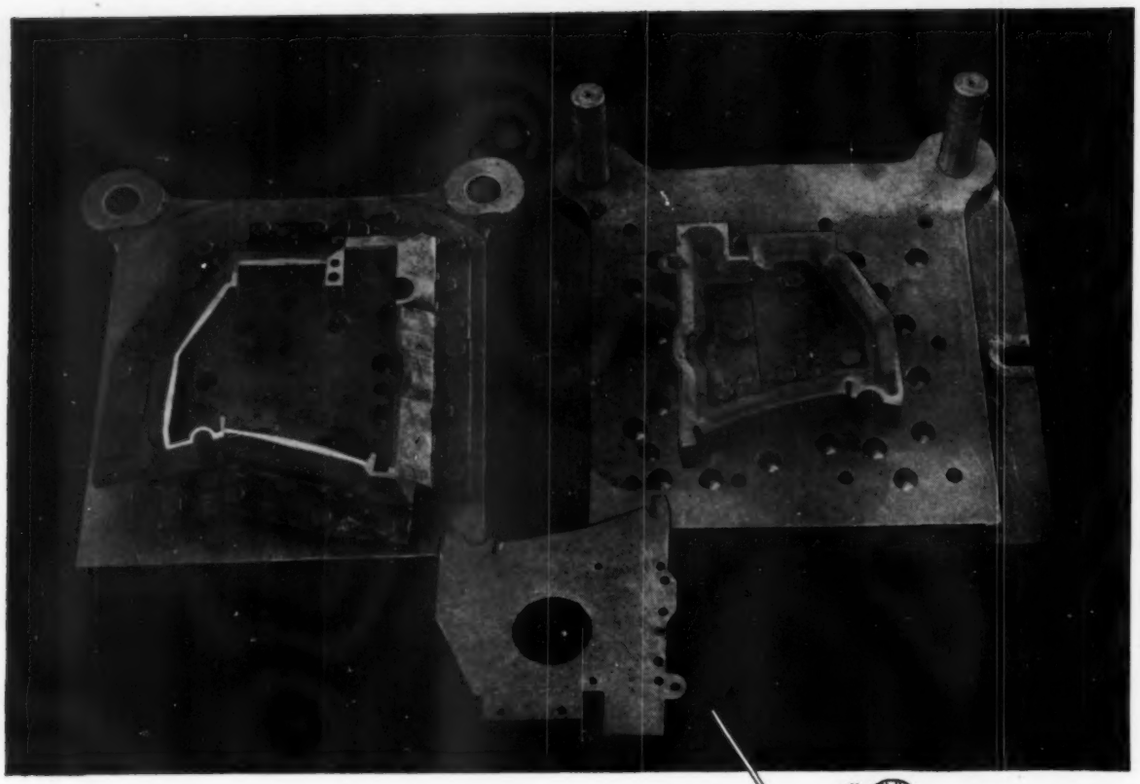
We are interested in your engineer calling to recommend definite ways to cut our individual Metal Removing Costs.

FIRM NAME ..... TITLE .....

BY .....

ADDRESS ..... STATE .....

CITY .....



How to *Cut Costs and "Corners"* on Your Blanking Dies

Write for New Booklet:

COMPOSITE DIE SECTIONS

Contains complete data on 35 Standard Die Sections, from combinations of which thousands of die shapes can be made —also full information on Special Die Sections, and how to order.

Get Your Copy— Write for it Today

ADDRESS DEPT. AM-74

You can save steel and time in the making of dies for blanking, trimming, beading, or any application involving the cutting of sheet metals to regular or irregular shapes, by assembling them from FCC Composite Steel Die Sections.

These prefabricated die parts consist of fine tool steel cutting edges, in a selection of grades, electrically welded by a special process to non-hardenable mild steel bases. Thus, screw and dowel holes may be easily drilled after heat treating, and there are numerous other advantages that will be immediately obvious to the die maker.

Thousands of die shapes may be made up from combinations of thirty-five standard sections. Specially shaped sections are manufactured to customers' specifications in five to ten days.

● Make *your* dies this money-saving way—full data on request.

ALLEGHENY LUDLUM
STEEL CORPORATION
Pittsburgh, Pa.

Forging and Casting Division

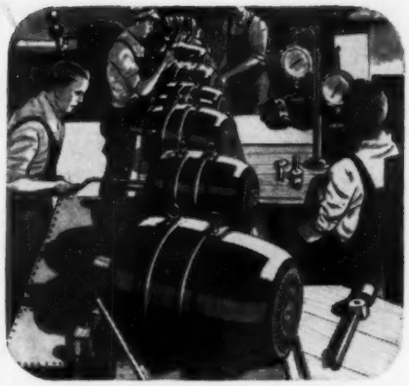
DETROIT 20, MICHIGAN

AL

W&D 1694

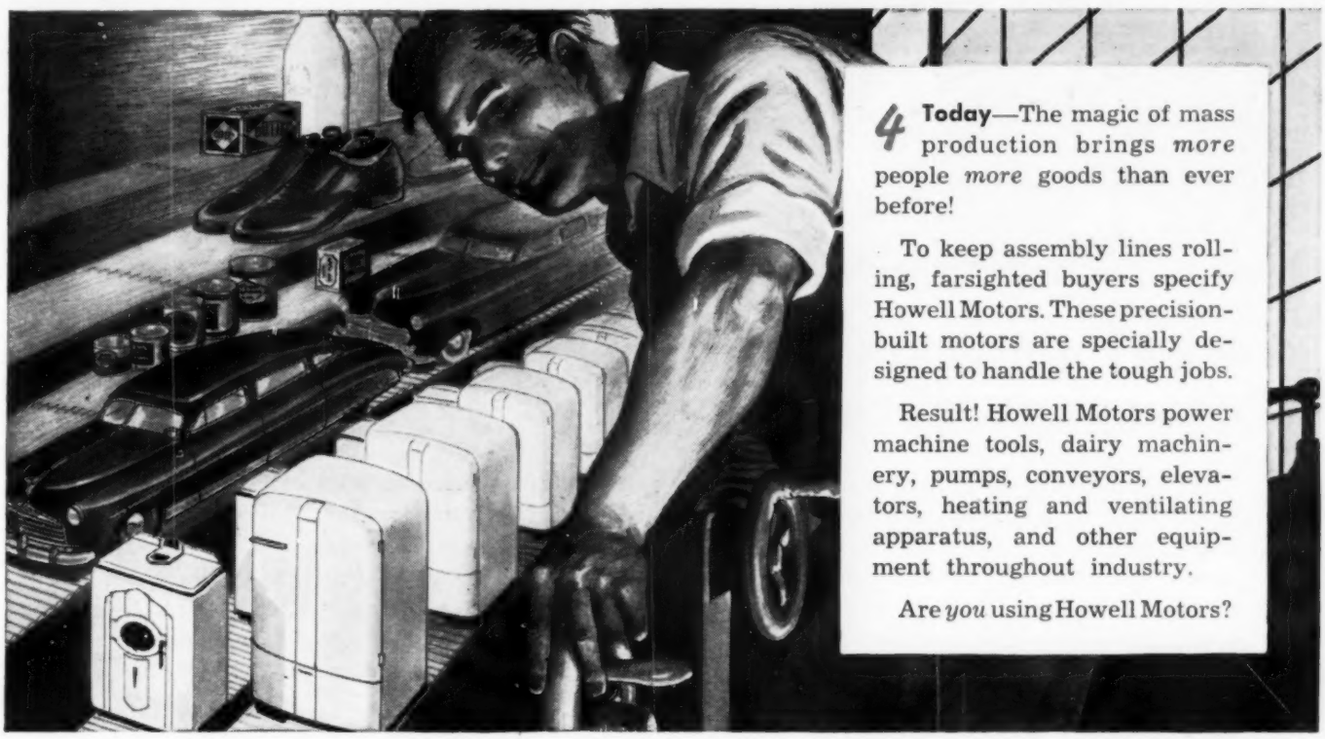
1 1780—Already the newly created Republic felt stirrings of the industrial greatness ahead. A Connecticut hat maker, for example, experimenting with *techniques* of increased production, pushed output to three a day.

2 1876—Mechanical marvels by the thousand at the Philadelphia Centennial dramatically spotlighted America's ability to invent, design, produce. Industrial stage was now set for impact of low-cost electricity, soon to come.



3 1915—Howell "Red Band" Electric Motors appeared! Soon, these rugged, industrial-type motors won recognition in hundreds of vital industries. Assembly lines were on the move! Ford produced its millionth car!

MASS PRODUCTION . . . AMERICA'S MIRACLE!



4 Today—The magic of mass production brings *more* people *more* goods than ever before!

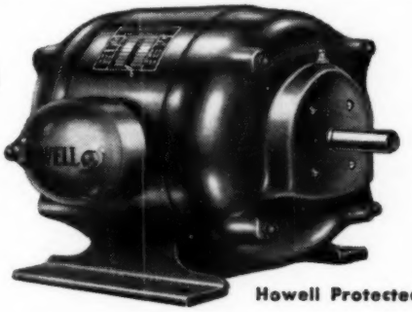
To keep assembly lines rolling, farsighted buyers specify Howell Motors. These precision-built motors are specially designed to handle the tough jobs.

Result! Howell Motors power machine tools, dairy machinery, pumps, conveyors, elevators, heating and ventilating apparatus, and other equipment throughout industry.

Are *you* using Howell Motors?

Free enterprise with mass production raises the standard of living—provides more *goods for* more *people at less cost.*

Here's another precision-built Howell Motor . . . industrial type with copper or bronze bar rotors . . . specially insulated . . . statically and dynamically balanced.

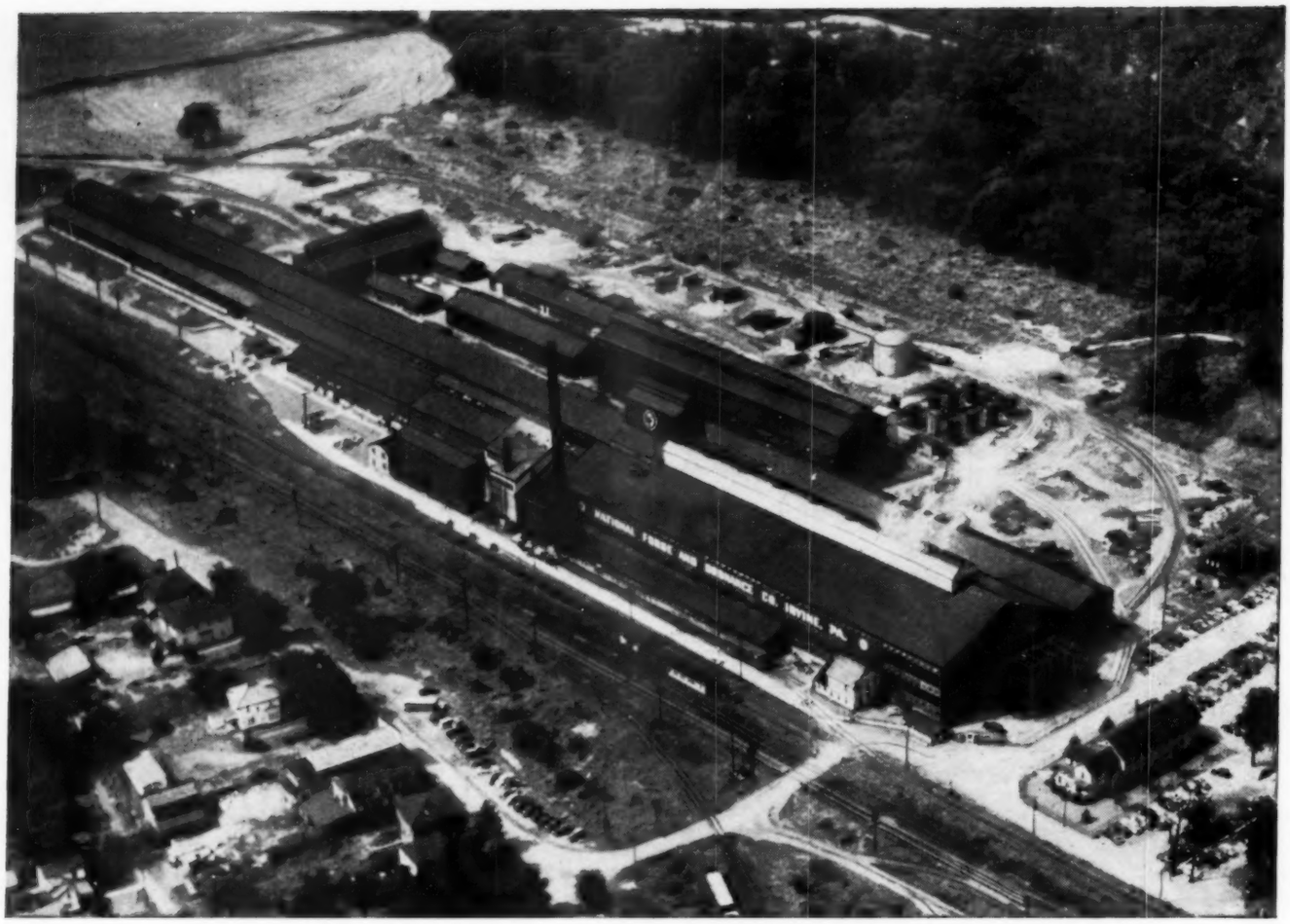


Howell Protected Type Motors

HOWELL MOTORS

HOWELL ELECTRIC MOTORS CO., HOWELL, MICH.

Manufacturers of Quality Industrial Type Motors Since 1915



WHAT GOES ON INSIDE THIS FORGING PLANT CONCERNS EVERY BUYER OF STEEL FORGINGS

It takes aerial photography to give a correct perspective of any large size, modern plant. And it also takes more than casual interest to have a correct perspective of what goes on inside a plant that is important to your business, product or production.

For if you use steel forgings—large or small—it is to your interest to know what happens at National Forge that enables this plant to consistently give you the best in steel forgings.

First of all, basic electric steel is made in this plant under rigid metallurgical and chemical control. National Forge makes its steel by the electric process—a melt for each forging—to assure steel of higher quality and cleanliness.

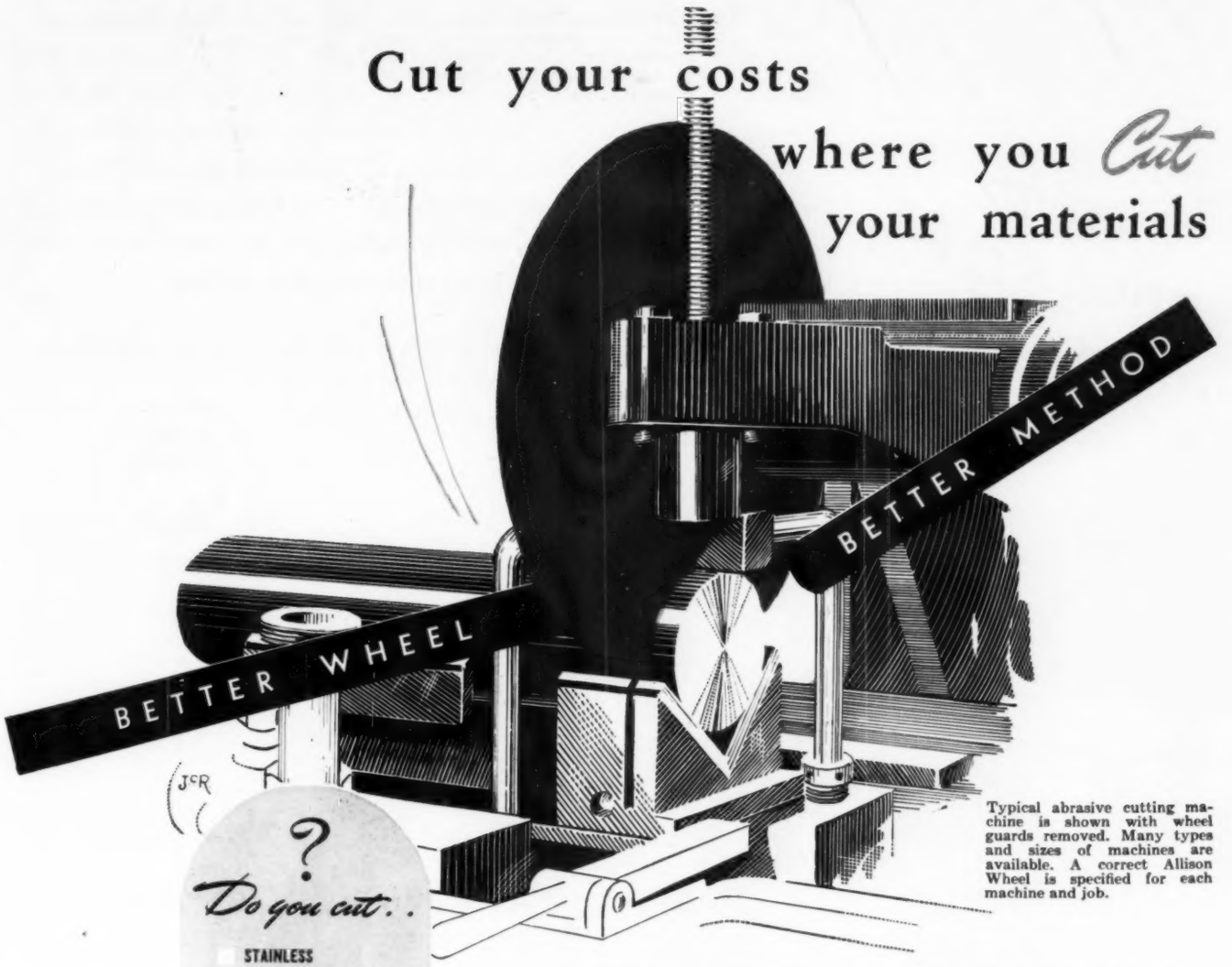
Forging equipment, manned by forgesmiths of long experience, shape this steel into forgings designed to possess the most desirable grain structure and physical properties. To acquire these desired characteristics modern heat treating facilities are provided. Both vertical and horizontal furnaces, equipped with the latest thermostatic control, are used for quenching, tempering, annealing, normalizing and spheroidizing. Vertical furnaces handle lengths up to 55 feet and horizontal furnaces take forgings up to 34 feet long.

The main machine shop extends for an unbroken length of a quarter of a mile and contains machine tools of the most modern design as well as essential handling equipment for efficient machine shop operation. In addition to the machining of forgings, this machine shop also houses a large department for contract machine work and assembly.

You should know in detail the many better ways in which this plant can serve you. A word by mail will bring you the interesting "inside the plant" story.

NATIONAL FORGE & ORDNANCE COMPANY, IRVINE, WARREN COUNTY, PA.

Cut your costs where you *Cut* your materials



Typical abrasive cutting machine is shown with wheel guards removed. Many types and sizes of machines are available. A correct Allison Wheel is specified for each machine and job.

? *Do you cut. .*

- STAINLESS
- UNANNEALED STEEL
- HARD COPPER TUBING
- ALUMINUM SHAPES
- GLASS ROD
- PLASTICS
- CERAMICS
- TUNGSTEN
- DRILL ROD
- BRASS

IF SO, *Check* AND CALL FOR AN *Allison* ABRASIVE CUTTING EXPERT

The chances are that your plant cuts materials in at least three departments . . . in your stock room, in your tool room and on your production line. At each point, modern high-speed, high-precision abrasive cutting offers important cost-saving possibilities.

Not only does the abrasive wheel slice through tough, difficult or "impossible" materials and cut to size within a few thousandths in a matter of seconds . . . it also leaves a finished surface that requires little or no further machining.

Certainly this is a time and cost-saving opportunity every production executive should investigate. An Allison Engineer, experienced in this one *specialized* field of abrasive application, will be glad to give you facts, figures and advice on the selection of equipment and wheels.

THE ALLISON COMPANY
256 Island Brook Avenue
Bridgeport 8, Connecticut

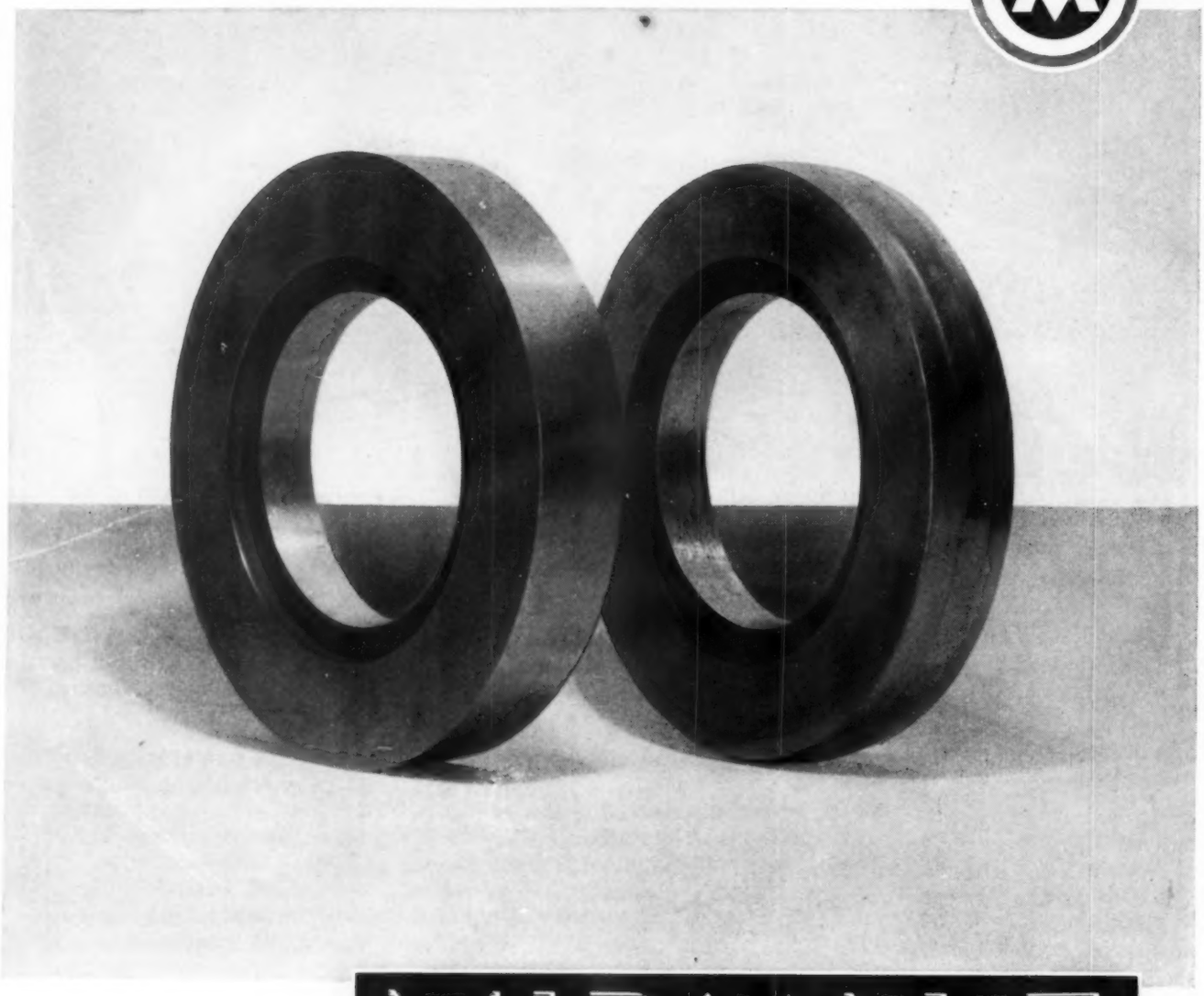
Allison ABRASIVE CUTTING WHEELS

TWIN TOOL STEELS

Midvale Diamond Brand and Diamond-A high carbon, high chrome tool steels meet customers' requirements for tools with high hardness, resistance to abrasion and minimum deformation. They differ in this respect: air hardening Diamond-A is somewhat more machineable and slightly less resistant to abrasion than oil hardening Diamond Brand. Both can be forged, as well as machined. They have a wide variety of application, including dies, rolls, punches, gauges, saws, paper mill knives, hobs, etc. Either can be depended upon to the limit.

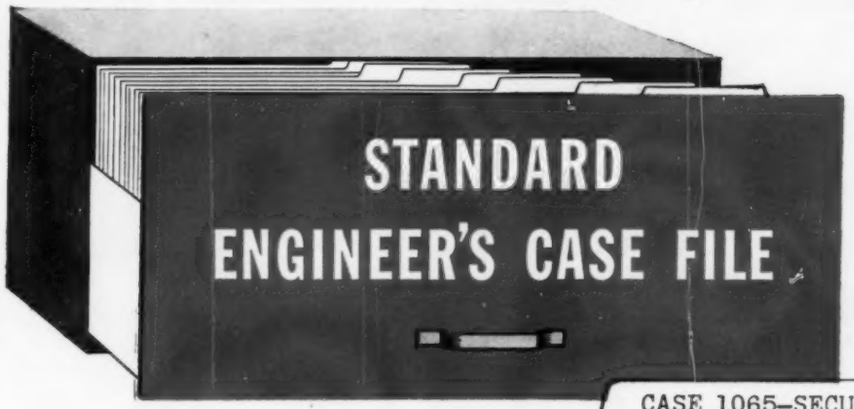
THE MIDVALE COMPANY • NICETOWN • PHILADELPHIA

OFFICES: NEW YORK • CHICAGO • PITTSBURGH
WASHINGTON • CLEVELAND • SAN FRANCISCO

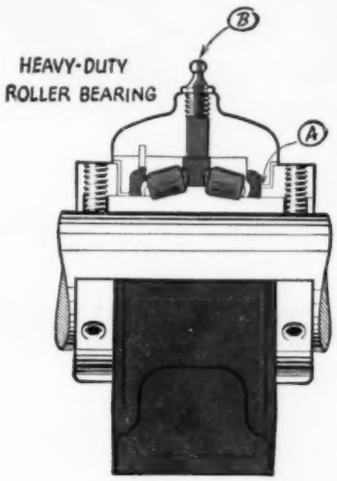


STAINLESS AND TOOL STEEL BARS
•
CORROSION AND HEAT RESISTING CASTINGS
•
FORGINGS AND RINGS

MIDVALE
Custom Steel Makers to Industry



CASE 1065—SECURING POSITIVE BEARING LUBRICATION IN HIGH RADIATED TEMPERATURES.



Calol S. A. Grease stopped leakage and drippage trouble in a large roller bearing even when bearing temperature, due to radiated heat, reached 250°F. and over. Originally developed for heavy-duty anti-friction bearings, but adaptable to many industrial grease-lubrication services where high ambient temperatures exist. Three grades: No. 00, No. 0 and No. 1.

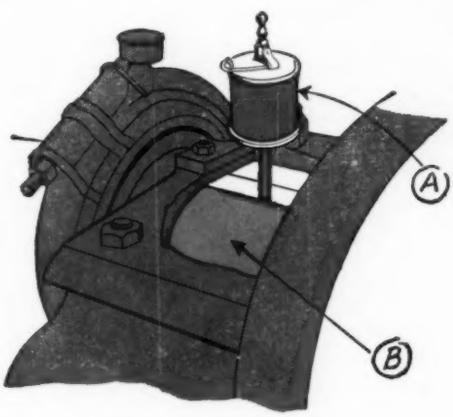
Has sodium-aluminum soap base - feeds evenly through bearings ... oil stock selected for high heat-resistant qualities.

A. Minimizes seepage through housings and seals.

B. Resists cold temperatures - pumpability remains good in all weather.

Calol S.A. Grease has proved excellent for low-, medium-, and high-speed anti-friction bearings. It is packed in 35-, 108- and 420-pound containers.

CASE 1063—REDUCING CONSUMPTION OF OIL USED FOR GENERAL INDUSTRIAL LUBRICATION.



STEAM ENGINE MAIN BEARING

In severe lubrication conditions, such as in the main bearing of a steam engine, consumption of compounded Calol Red Engine Oil X was 20 to 30 percent less than that of straight mineral oil. It is recommended for all types of bearings except high-speed, flood lubricated, anti-friction bearings where pickup may be excessive. Comes in three grades: 13X, 16X and 26X.

A. May be applied by all types of oiling systems - compounds promote better circulation in ring-, and chain-oilers.

B. Contains stringiness and oiliness additives. Forms tacky "oilskin" on bearings - resists heavy loads and high temperatures. Reduces friction, high starting torque and wear.

Calol Red Engine Oil X has excellent metal-wetting ability - protects metal against rusting even in high humidity conditions. Cools rapidly.

For additional information and the name of your nearest Distributor, write

STANDARD OIL COMPANY OF CALIFORNIA

225 Bush Street, San Francisco 20, California

The California Oil Company
30 Rockefeller Plaza, New York 20, N.Y.

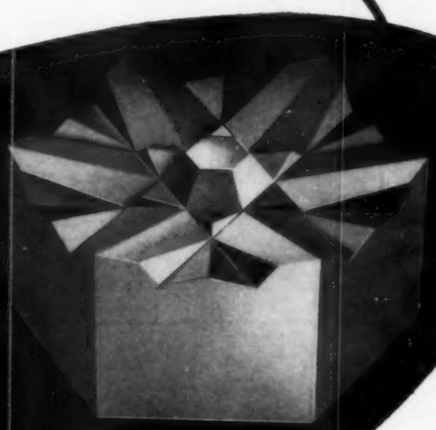
The California Company
17th and Stout Streets, Denver 1, Colo.

Standard Oil Company of Texas
El Paso, Texas

RPM CALOL

Trademarks Reg. U. S. Pat. Office

60 DIFFERENT FACETS



YET

THE PIECE WAS MOUNTED ONLY ONCE

Illustrative of the unusual flexibility of the Hendey 12" Shaper, the piece pictured above, was finished after being mounted *only once in the shaper's vise.* The operator took advantage of the universal table and made six different cuts to form an ordinary hexagon bar into an intricate shape with sixty facets.

But this is only one of several features inherent in the Hendey 12" Shaper. Production-wise you'll be able to remove metal at the rate of 182 feet per minute on a 6-inch stroke, with a vibrationless action that permits the highest degree of accuracy on fine tool and die work. Operation is simple and can be accomplished, through dual controls, from either side of the machine.

Offering performance hitherto unapproached in facility of operation, high rate of production and accuracy of work, the Hendey 12" High Speed Universal Crank Shaper is a machine you should investigate. Write today for catalog giving complete details.

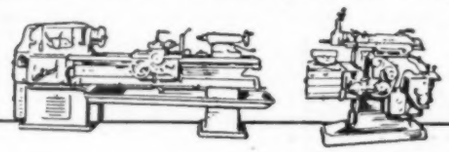
The Hendey Machine Company

Hendey

Main Office and Plant — Torrington, Connecticut

Offices — N. Y., Chicago, Boston, Detroit, Rochester, Los Angeles, San Francisco

Representatives in — Philadelphia, Cleveland, Pittsburgh



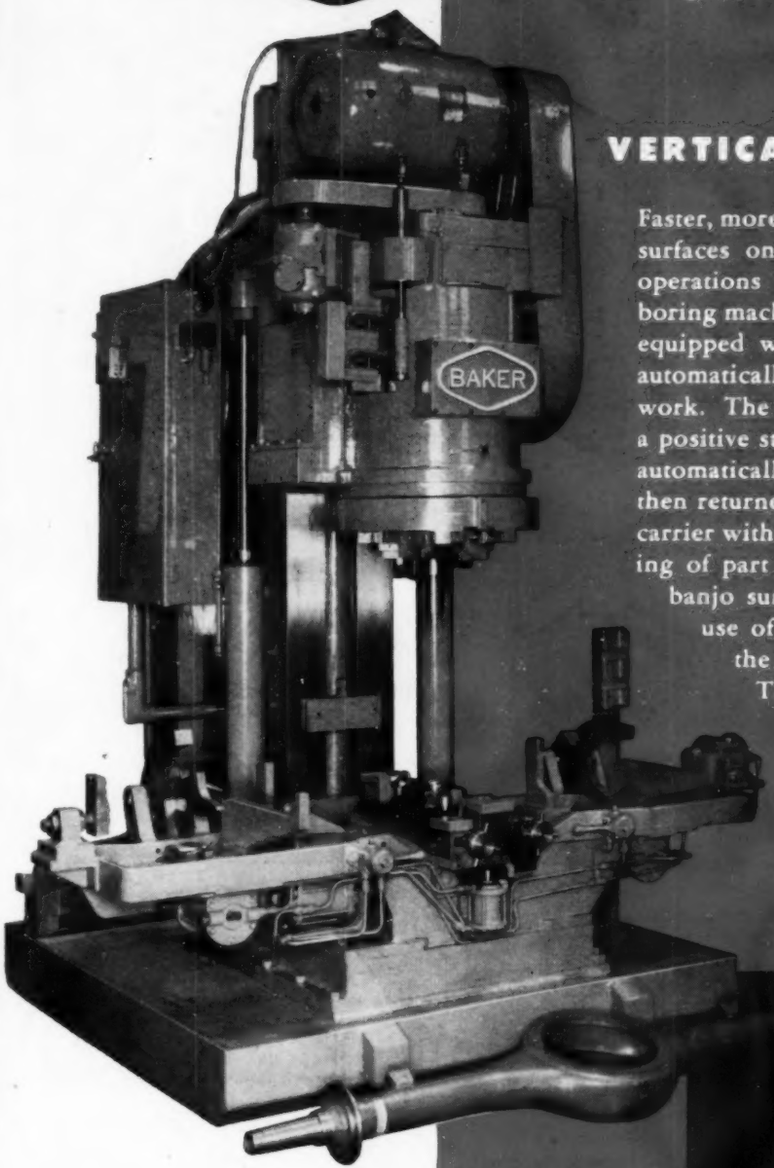
TOOL ROOM LATHES
12" - 14" - 16" - 18" - 20"

SHAPERS
12" - 16" - 20"

BAKER

Cross Feed Facing On Axle Housings

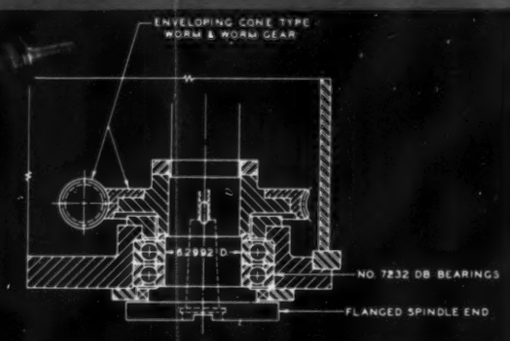
WITH BAKER VERTICAL BORING MACHINE



Faster, more accurate cross feed facing of the banjo surfaces on axle housings is performed in two operations with the Baker 30 HO-4 heavy duty boring machine. In this application the machine is equipped with two cross feed tool carriers that automatically feed carbide tipped cutters across the work. The head is hydraulically fed downward to a positive stop, at which time the tool carriers are automatically fed out across the work. The head is then returned to the upward position and the tool carrier withdrawn to the starting position. Clamping of part is Air Actuated while leveling of the banjo surface is rapidly accomplished through use of two adjusting knobs on the front of the fixture.

The Baker 30 HO-4 boring machine may also be adapted to simultaneous boring and facing operations. Write Baker today concerning your specific problem.

BAKER MACHINERY— ENGINEERED FOR GREATER PRODUCTIVITY SINCE 1867.



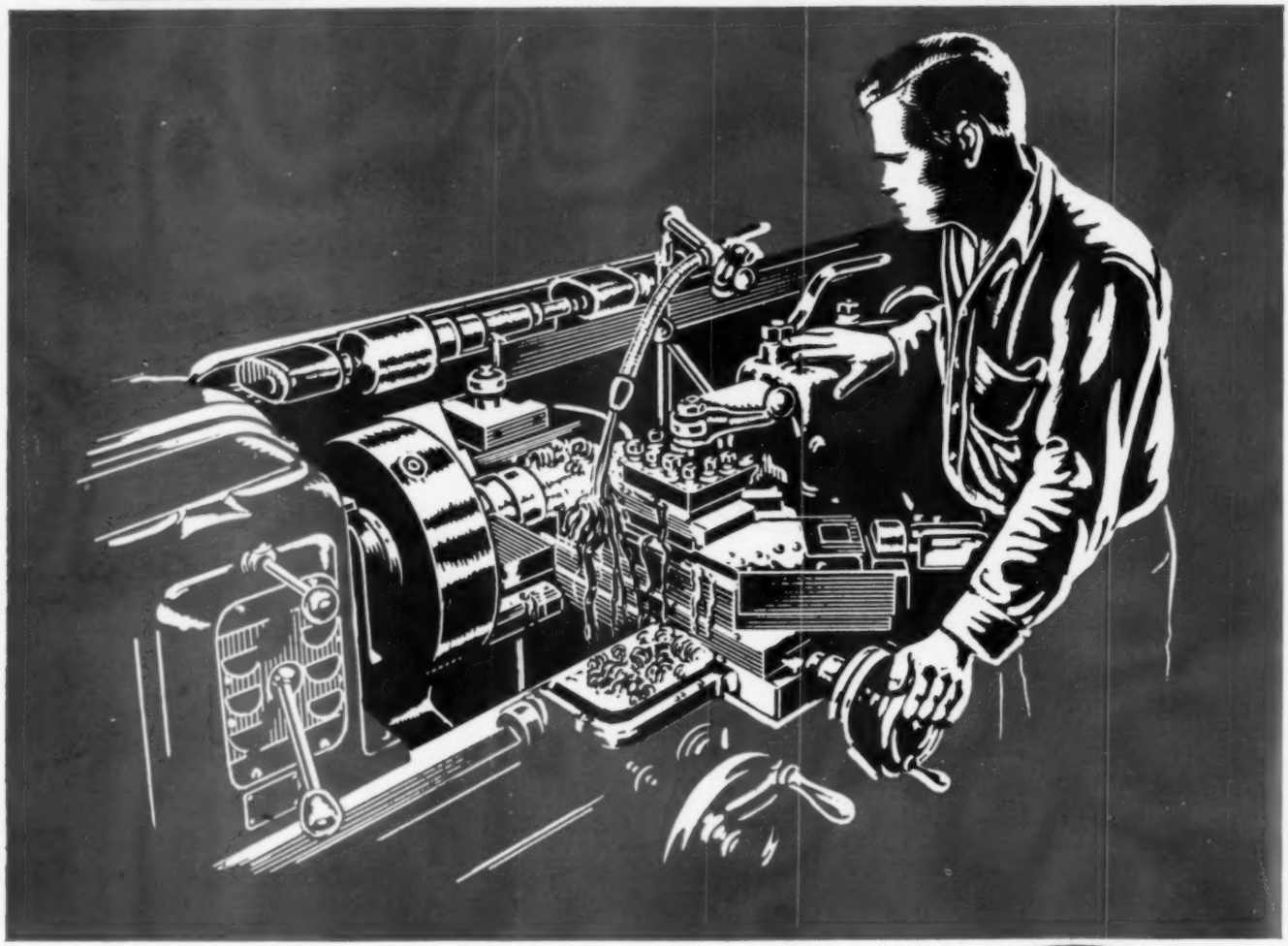
PARTIAL SECTION VIEW OF EXTRA HEAVY DUTY HEAD ON SADDLE OF 30 HO 4 MACHINE
NOTE LARGE DIAMETER SPINDLE AND LOWER POWERFUL SMOOTH DRIVE

BAKER BROTHERS, Inc., Toledo, Ohio

DRILLING . . . TAPPING . . . KEYSEATING . . . CONTOUR GRINDING MACHINES

YES! Tycol Afton Cutting Oils

perform better . . . BETTER . . . BETTER



Tycol Afton Cutting Oils perform better because:

. . . *Tycol Afton Cutting Oils* are "Dual Purpose" oils refined to give better 2-job performance—BOTH cutting and machine lubrication.

. . . *Tycol Afton Cutting Oils* give thorough protection to gears and bearings—won't corrode or harmfully affect metal parts.

. . . *Tycol Afton Cutting Oils* minimize build up on cutting tools . . . permit faster cuts . . . lengthen tool life between grinds . . . improve finish.

. . . *Tycol Afton Cutting Oils* won't harmfully affect or corrode copper, aluminum or their alloys.

For complete information about Tycol Afton Cutting Oils and the other lubricants that make up the complete Tycol line, write your nearest Tide Water Associated Office.

LUBRICATION — "ENGINEERED TO FIT THE JOB"

TYCOL

INDUSTRIAL LUBRICANTS

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TIDE WATER ASSOCIATED OIL COMPANY

17 BATTERY PLACE · NEW YORK 4, N.Y.

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HY-PRO TAPS

COMMERCIAL · PRECISION · SPECIAL
Ground Thread Taps

"Sustained Accuracy" is the only true guide in measuring TAP Economy and Efficiency

Many more accurately threaded holes per tap are produced when the tap maintains its size longer.

Time studies, as well as competitive tests have proved the "sustained accuracy" of HY-PRO Taps . . . the extra hard, tough taps that require less sharpening.

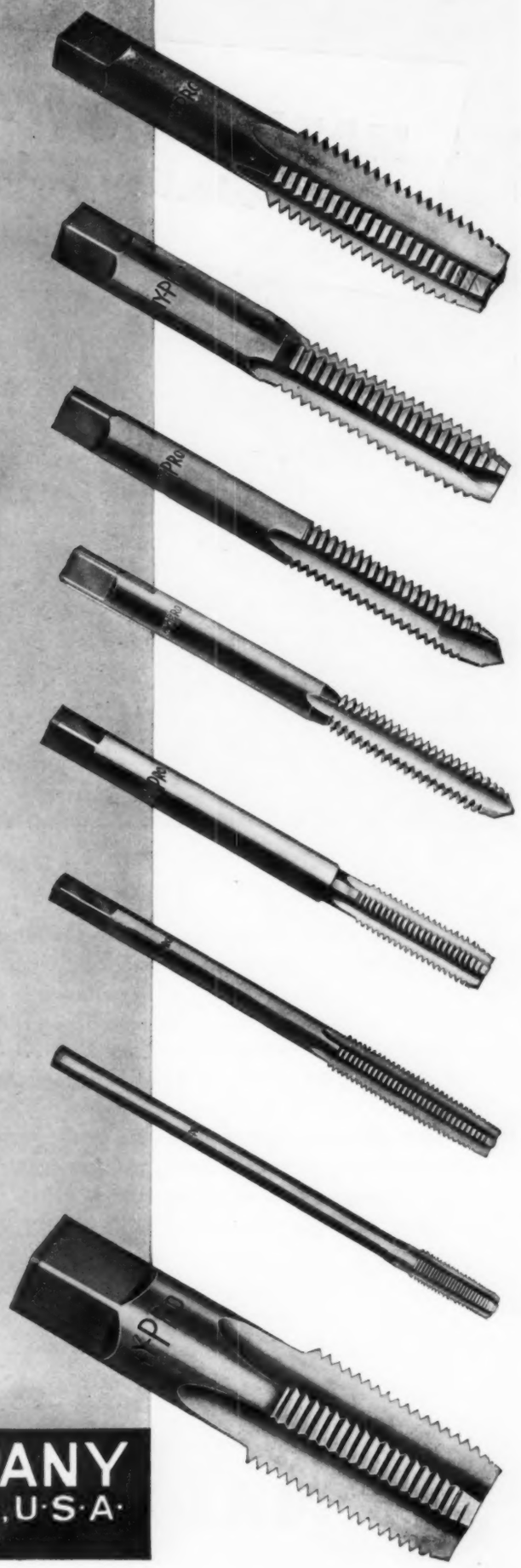
Precisely ground to exacting standards from the hardened solid, HY-PRO Taps are extremely rugged, yet accurate; wear longer between sharpenings; stay on the job longer. Their stamina and precision will aid in your efforts to offset high labor costs through greater production.

Specify HY-PRO for High Production at Less Cost in all tapping operations.

Have your name placed on our bi-monthly mailing list to receive the HY-PRO Stock List.

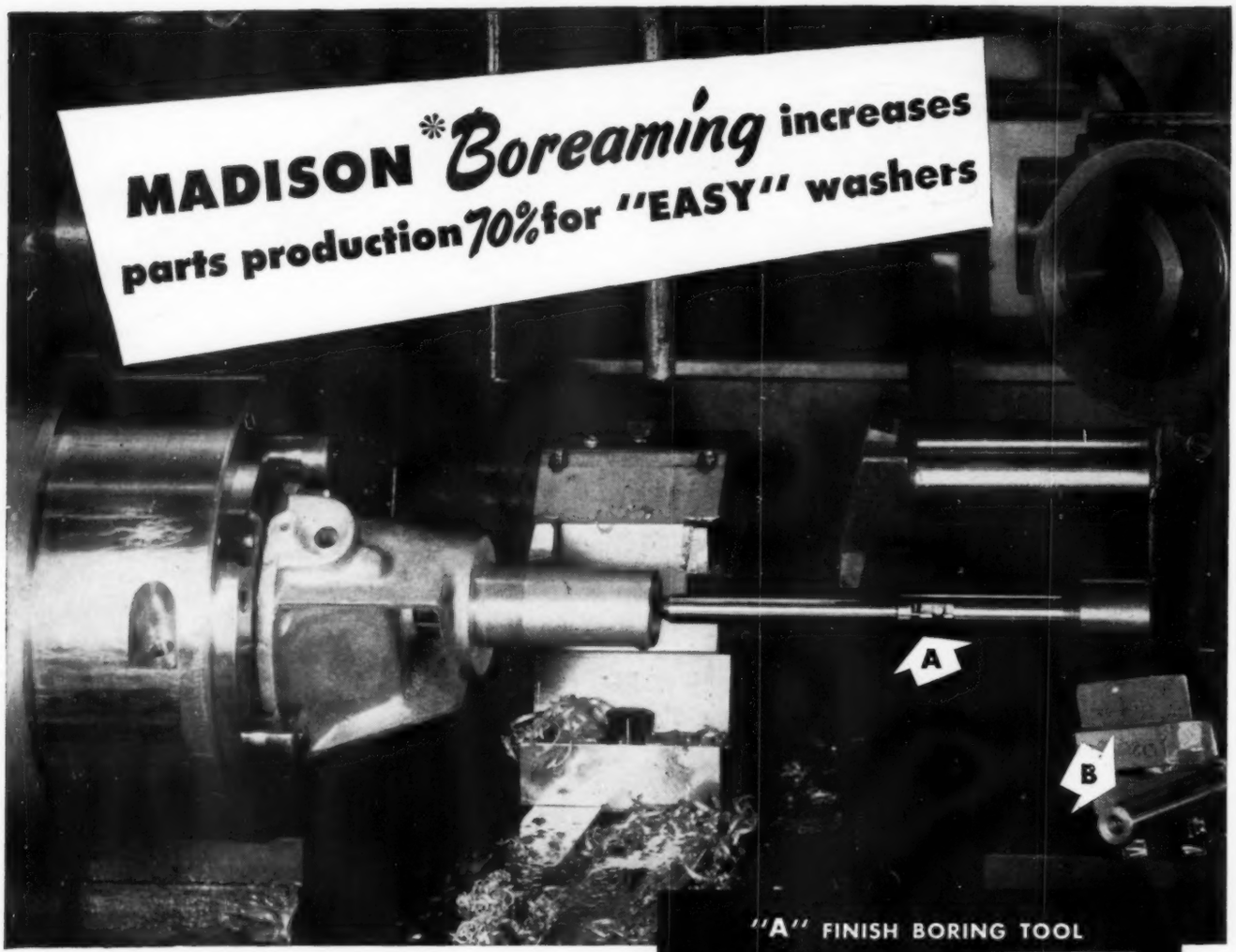
PROMPT DELIVERY. Many Special as well as Standard Taps in stock.

ORDER THROUGH YOUR DISTRIBUTOR

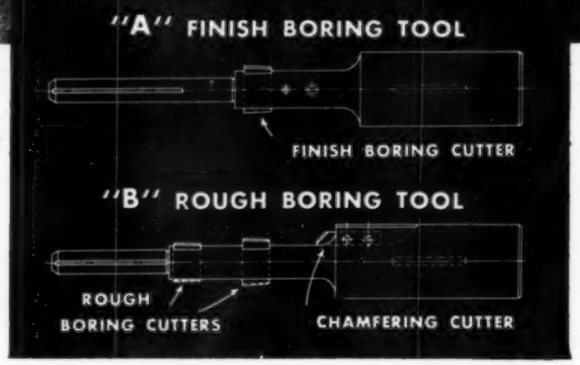


HY-PRO TOOL COMPANY
New Bedford, Massachusetts, U·S·A·
A Subsidiary of Continental Screw Co.

MADISON *Boreaming increases parts production 70% for "EASY" washers



*Completed boring operation



Here's the story: An aluminum casting required the following operations on inside and outside diameters — Rough bore 1st ID — Rough bore 2nd ID — Finish 1st ID — Chamfer ID — Face Shoulder — Turn 1st OD — Turn 2nd OD — Finish 1st OD — Finish 2nd OD — Thread 2nd OD.

Using single point tools, all six of the turret faces were required to finish a single casting. 19.7 parts per hour were completed.

With Madison Boreaming, EASY WASHING MACHINE CORP. was able to accomplish the same machining on three turret faces, permitting two completed castings per turret revolution. 33.6 parts per hour were completed.

Thus with two Madison tools EASY gained a production increase of 70.5%. Why not put Madison Boreaming to work for you? Write for the new Madison Catalog. It shows complete lines, prices and grinding instructions.

Write for the Madison catalog today. Get the facts on Madison Boreamers, the tools that make one operation out of boring and super finish reaming.

MADISON ADJUSTABLE REAMING TOOLS

MADISON MANUFACTURING COMPANY
DEPT. AM-6 MUSKEGON, MICHIGAN

NILES

Now...Niles Machine Tools—

carry this nameplate too...

With the formation of Lima-Hamilton Corporation, two of the country's oldest and best-known manufacturing concerns in the heavy equipment field were combined.

General Machinery Corporation — with origins dating back to 1845 — has been well known for its Niles line of heavy and medium machine tools for railroads and industry in general. It has, in addition, a well-established reputation in the diesel engine and press business. Lima Locomotive Works has been a large producer of steam locomotives for 78 years and, for 20 years, a major builder of power shovels and cranes.

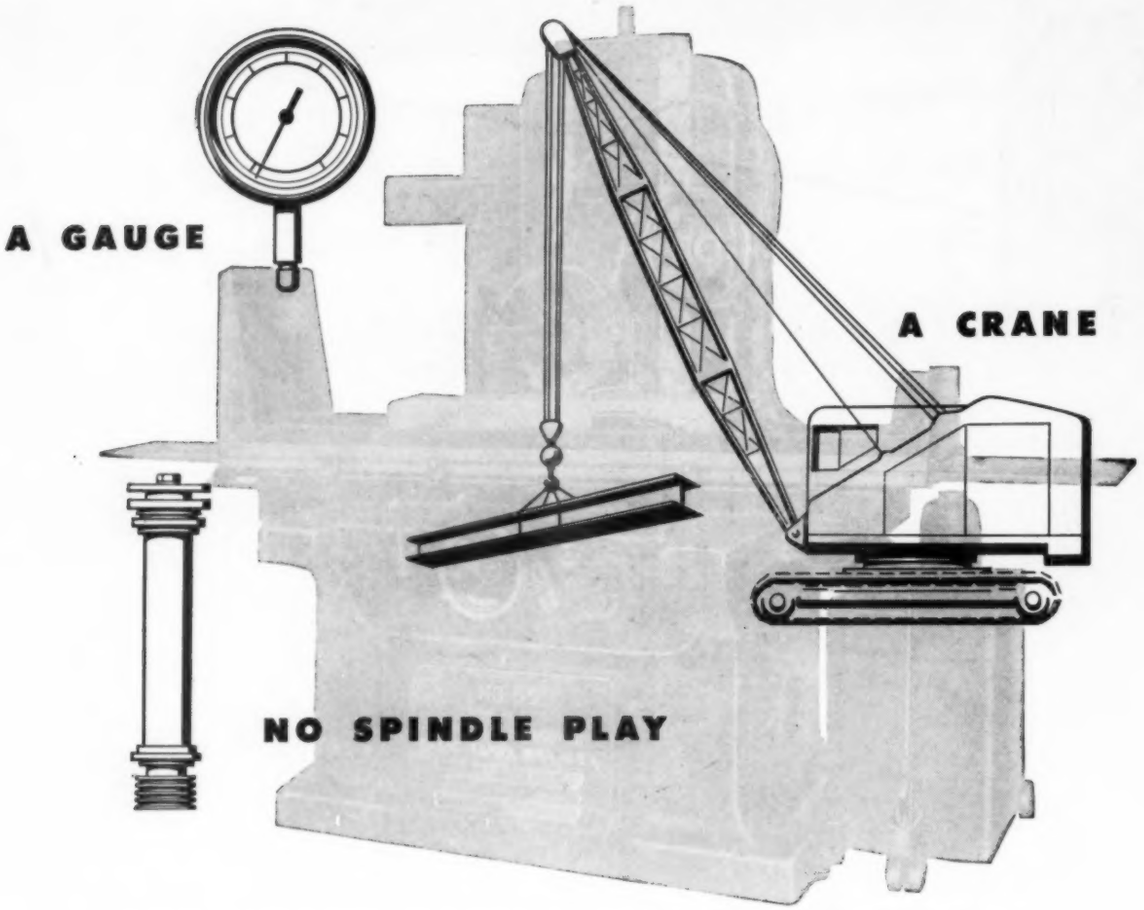
Facilities of the two companies (within 100 miles of each other) complement manufacturing lines and effect economies in operation. Research and development work has been stepped up, utilizing the combined experience and engineering talent of the two companies. Result: new and better products soon to be announced.

Thus, users of Niles machine tools genuinely benefit from the fact that now all Niles tools carry the Lima-Hamilton diamond too.

LIMA
HAMILTON
CORPORATION

DIVISIONS: *Hamilton, Ohio* — Niles Tool Works Co.; Hooven, Owens, Rentschler Co. *Lima, Ohio* — Lima Locomotive Works Division; Lima Shovel and Crane Division.

PRINCIPAL PRODUCTS: Niles heavy machine tools; Hamilton diesel and steam engines; Hamilton heavy metal stamping presses; Hamilton-Kruse automatic can-making machinery; Locomotives; Cranes and shovels; Special heavy machinery; Heavy iron castings; Weldments.



AND GRAND RAPIDS' MICRO-ACCURACY*

A precision gauge can be only as accurate as the grinding machine used to finish-grind it. The sub-assemblies of a giant crane present an entirely different grinding problem. Whether in removing a few ten thousandths of metal in a high-accuracy operation, or in removing a lot of metal with greater allowable tolerances, freedom from spindle play is extremely important. That's just one of the reasons why you find Grand Rapids Grinders in so many leading plants of all types — from manufacturers of precision gauges to makers of huge cranes. Other assurances of long-life accuracy and speed are: the fastest longitudinal table speed (125 f.p.m.) available in any grinder; vibrationless rigidity achieved by massive one-piece column and base casting; patented vertical head adjustment; Bijur one-shot lubricating system.

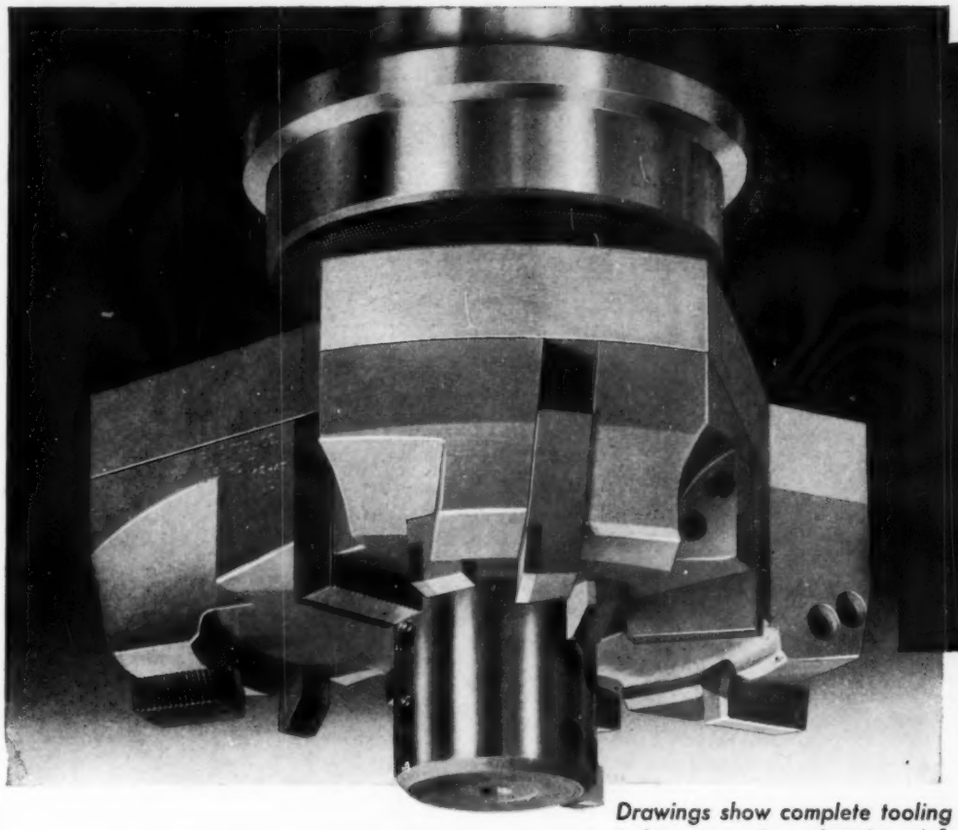
*Accuracy within 0.00025 limits.

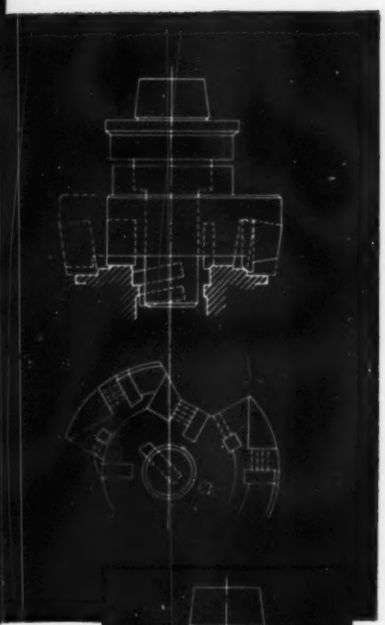
TO SERVE YOU — *Your inquiry concerning your specific grinding needs will receive prompt attention. Grand Rapids Grinders include: Hydraulic Feed Surface Grinders, Universal Cutter and Tool Grinders, Hand Feed Surface Grinders, Tap Grinders, Drill Grinders, and Combination Tap and Drill Grinders.*

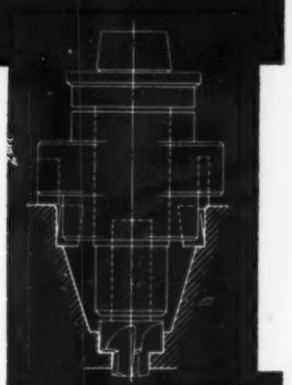
GALLMEYER & LIVINGSTON COMPANY

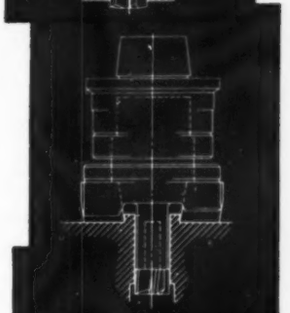
330 Straight Ave., S.W., Grand Rapids 4, Michigan

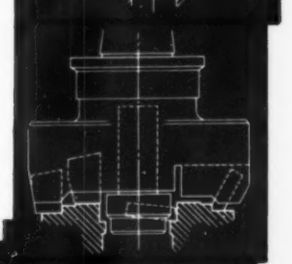
GRAND RAPIDS GRINDERS

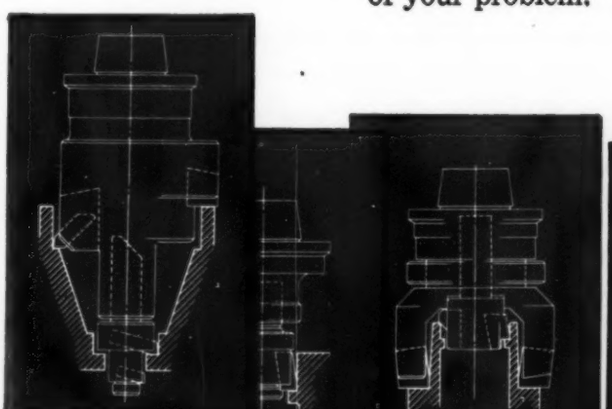


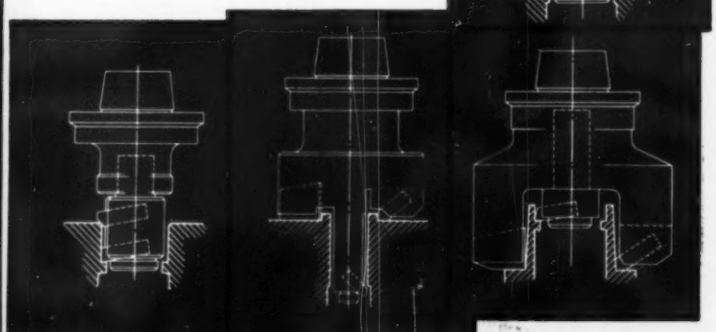












Drawings show complete tooling for a two-way, trunnion-type, four-spindle, roughing and precision boring machine, producing power take-off units. Each tool performs one or more operations such as boring, counterboring, chamfering, facing, and hollow milling.

Multiple Tooling

More precision parts at lower costs are made possible through specially designed inserted blade cutting tools.

This actual example of multiple tooling recently completed by GAIRING suggests how the use of sound and proven principles of cutting tool design might improve the production of *your* machines.

So, if your present production falls short of expectations, let GAIRING'S engineers make a comprehensive analysis of your problem.

GAIRING TOOLS

THE GAIRING TOOL COMPANY · DETROIT 32, MICHIGAN

Add this Time Saver to Your Equipment—

"HARDSTEEL" DRILL

The drill that drills hardened steels — without annealing.

When last minute changes come through on hardened parts and dies—drill without annealing using "HARDSTEEL" drills—and save time.

When parts must positively match at assembly—harden first, then drill with "HARDSTEEL" drills—and save time.

When case hardened steels must be drilled, use "HARDSTEEL" drills to get through the case—and save time.

When holes must be drilled in any work hardening steel or in special tools made of fully hardened steel—use "HARDSTEEL" drills and save time.

Yes, "HARDSTEEL" drills, made of special material and to a special design eliminate all annealing and the distortion usually caused by rehardening. They work on steels hardened by any process to 40 Rockwell "C" or harder.

The "HARDSTEEL" Operators Manual will give you many tips on how this well known tool can save time and material in your plant. Copy free on request.

You Harden it—We'll drill it—with "HARDSTEEL"

"HARDSTEEL" Tool bits make faster, deeper cuts on steels and non-ferrous alloys.

BLACK DRILL CO., *Division Black Industries*
1390 East 222nd Street — CLEVELAND 17, OHIO

"HARDSTEEL"
DRILLS • TOOL BITS • SPECIALS

TUTHILL V-BELT UNITS FOR HANDLING HEAVY LIQUIDS

Tuthill V-belt pumping units are compact, quiet, economical . . . built for long dependable service with negligible maintenance in handling viscous liquids. Features include internal gear rotary pumps, outboard ball-bearing shaft support, belt tension adjustment by one set screw, and a wide range of speeds, capacities and pressures.

Write for Bulletin on Tuthill Viscous Liquid Pumps

Tuthill Pump Company
939 East 95th Street, Chicago 19, Illinois

PRESSES
FEEDS
AUTOMATIC EQUIPMENT
THE V & O Press Co.
HUDSON N Y

Die-Making Machines

They save 50% on sawing, filing and lapping operations, easily maintaining .002" limits. Ask for special bulletin—also circulars on Drill Grinders, Point Thinners, Tool and Cutter Grinders, Face Mill Grinders and Tool Bit Grinders.

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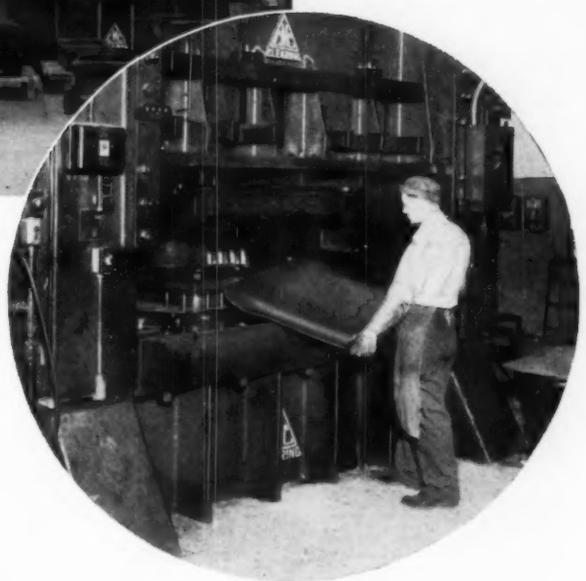
Oliver Instrument Co., 1414 Maumee St., Adrian, Mich.

For *Faster Smoother Cleaner* *Grinding*
ECONOMY
THE W&B CO.
Grinding and Cutting Oils and Lubricants for Every Metal Working Purpose

THE WHITE & BAGLEY COMPANY
WORCESTER, MASS. • DETROIT, MICH.

CMC
CLEARING
MECHANICAL & HYDRAULIC



INSET: A completed piece, ready for assembly, at every stroke. Contrast this with molding, pouring, shaking, grinding, and drilling operations required to produce a comparable piece the old way.

GO ALL THE WAY WHEN YOU ELIMINATE FOUNDRY EXPENSE

Casting metal is a slow method of production—grinding and drilling afterwards are expensive operations. The products or parts you manufacture—could they be changed to stampings? If so, any press can show you great savings in cost, but Clearing presses usually cut costs deepest.

That's not merely enthusiastic claim. It's a statement of fact, and convincing proof is ready and waiting for any manufacturer who wants to turn out quality merchandise in quantity at bed rock costs. If that means you, get in touch with us.

In these pictures you see Clearing presses helping to keep quality up and costs down in a modern kitchen range plant. Whatever your line, they can probably do the same for you.

CLEARING MACHINE CORPORATION • 6499 West 65th Street • Chicago 38, Illinois

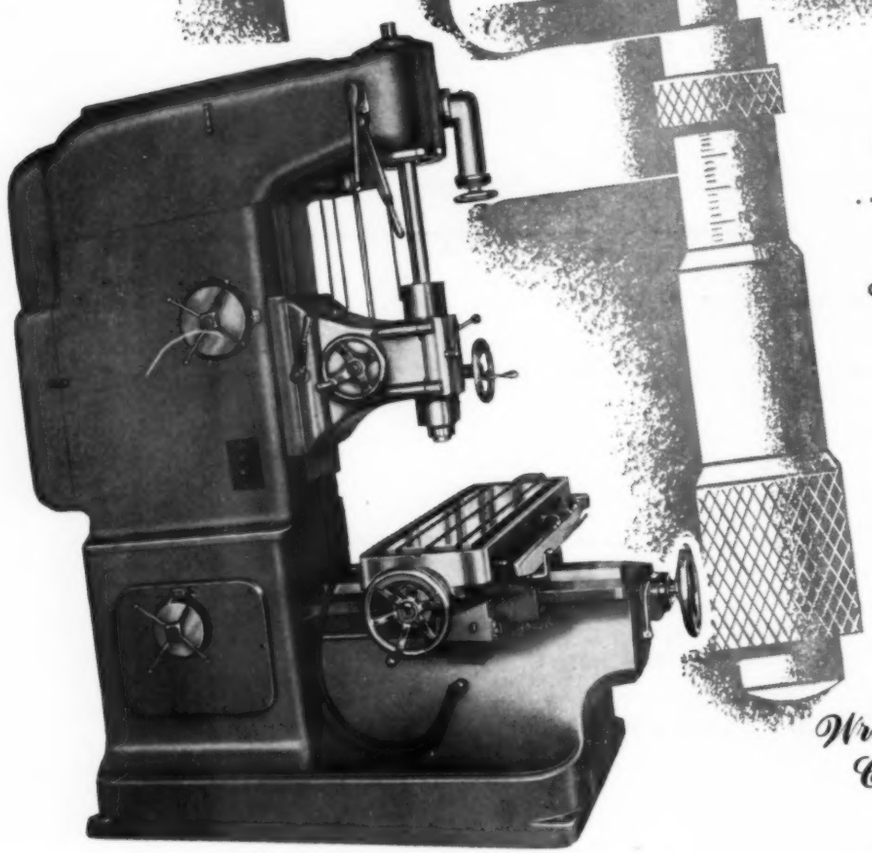
CLEARING THE WAY TO EFFICIENT MASS PRODUCTION

CMC CLEARING

EXCEPTIONAL ACCURACY, SPEED AND POWER

No. 50 PRECISION BORING AND VERTICAL MILLING MACHINE

★ Reduces Set-Up Time To A Minimum
★ Eliminates Time-Wasting Work Transfers
★ Multiple Operation On A Single Machine
★ Greater Output At Lower Unit Cost



The No. 50 is a machine built for precision as well as speed . . . with unusual ability to handle an extreme range of different and difficult jobs. Simple and convenient to operate — ruggedly constructed for many years of tough, trouble-free service — the Knight Miller offers worthwhile savings in greater output, lower production costs and improved quality of work.

Write for Complete Catalog Details

Sixteen spindle speeds, 40 to 2,000 r.p.m. • 9 spindle feeds, .005" to .010" • 100" table traverse per minute in both directions • Sixteen table feeds, $^{3}/_{16}$" to 20" per minute • 7½ h.p. drive.

KNIGHT VERSATILE MILLERS ACCURATE RIGID

W. B. KNIGHT
MACHINERY COMPANY

MORE GOODS for MORE PEOPLE at LOWER COST

3920 WEST PINE BLVD. • ST. LOUIS 8, MISSOURI

These Bolts are covered with grime

These Bolts are loaded with burrs

These Bolts are clean and smooth

Circle Ⓑ Bolts and Nuts . . . both standard and special . . . are produced by skilled bolt-makers with years of experience. This is reflected in the finished appearance as well as the overall quality of these famous products.

BUFFALO BOLT COMPANY

North Tonawanda, N. Y.

SALES OFFICES IN PRINCIPAL CITIES

Export Sales Office · Buffalo International Corp., 50 Church Street, New York City

...they are CIRCLE Ⓑ BOLTS

★
SAVES TIME
MAKES MONEY
★
CUTS ANY SHAPE
CUTS ANY SIZE
★
CAPACITY UP TO
1/4" STOCK

MARSHALLTOWN
THROATLESS SHEARS

Here's the shear that offers best performance features. Cutting speed 6' per minute. High grade tool steel cutters. Write today for details. Prompt shipment.

MARSHALLTOWN MANUFACTURING COMPANY
910 Nevada Street Marshalltown, Iowa

Wherever accuracy is important
. . . so is accuracy *CONTROL!*

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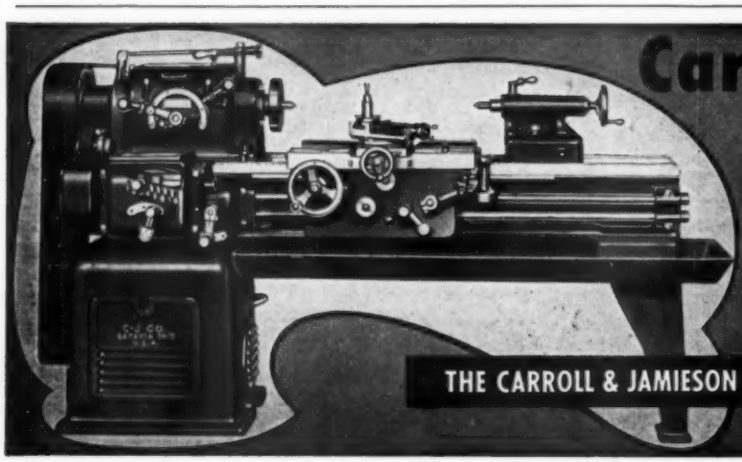

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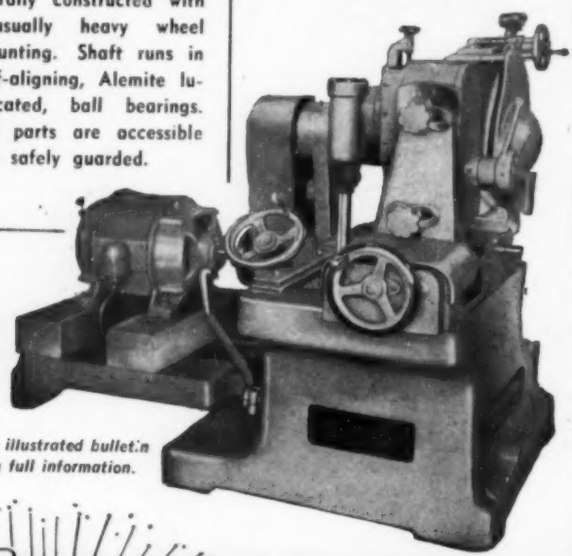

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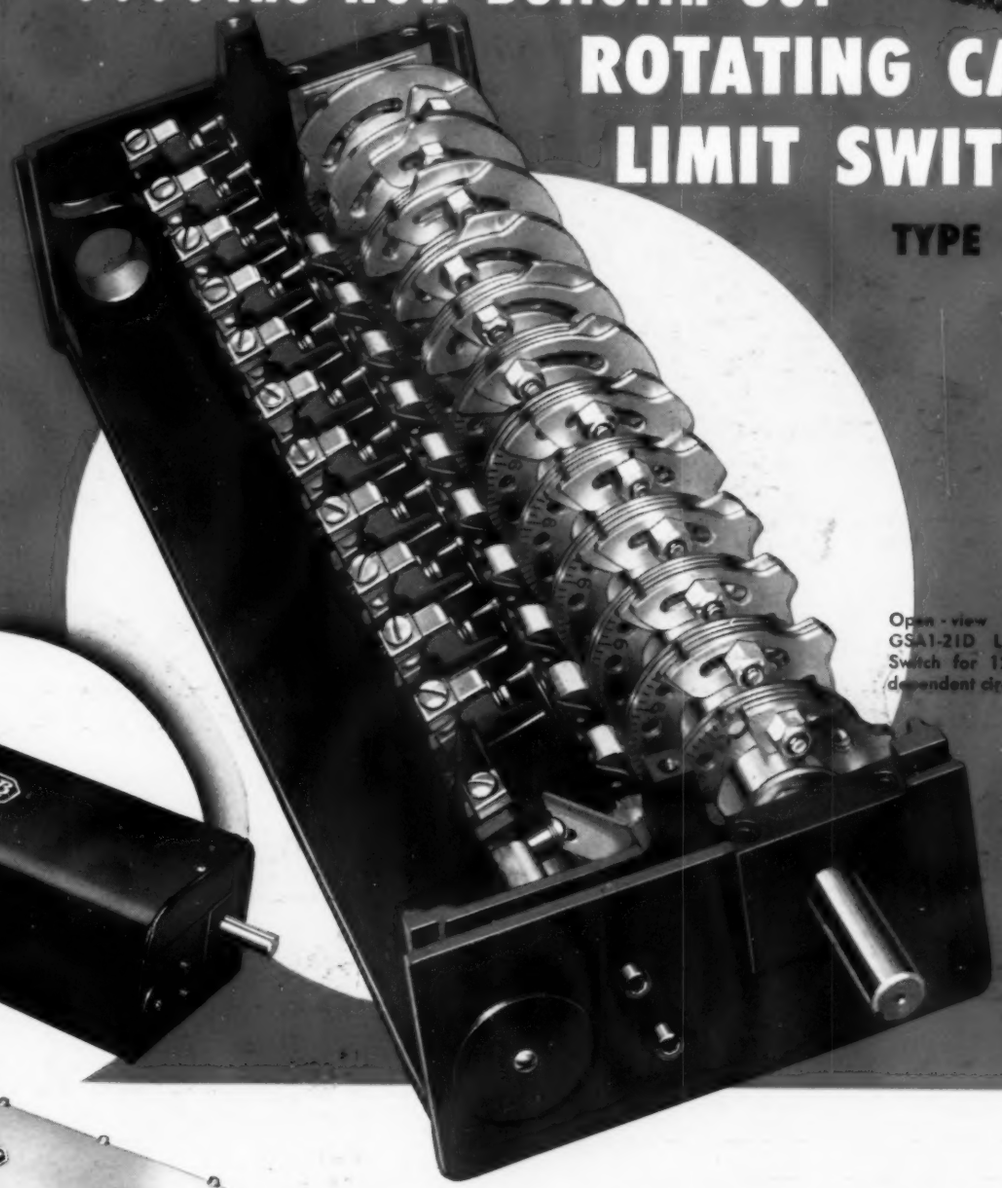
TYPE GSA1



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Standard, general purpose, pressed steel enclosure.

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Double-break, silver-alloy contacts.

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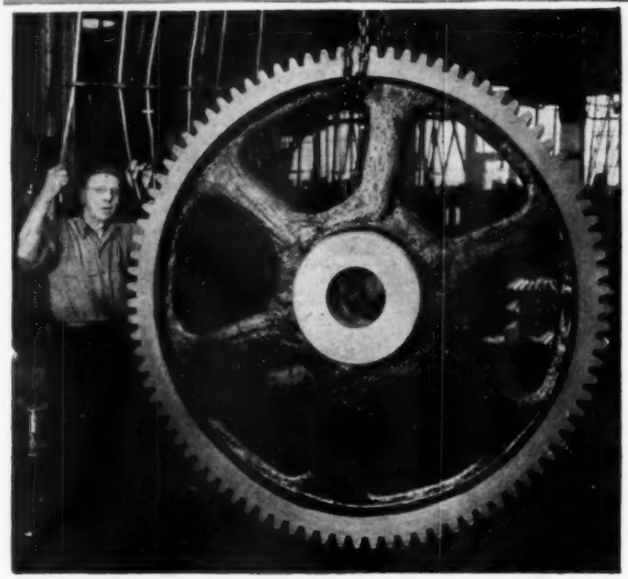

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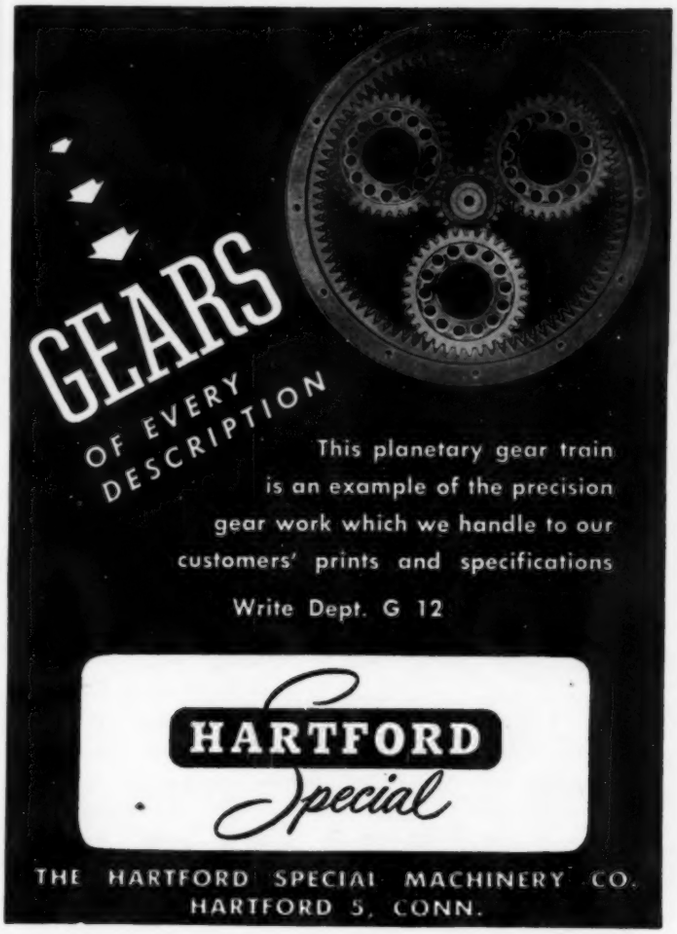
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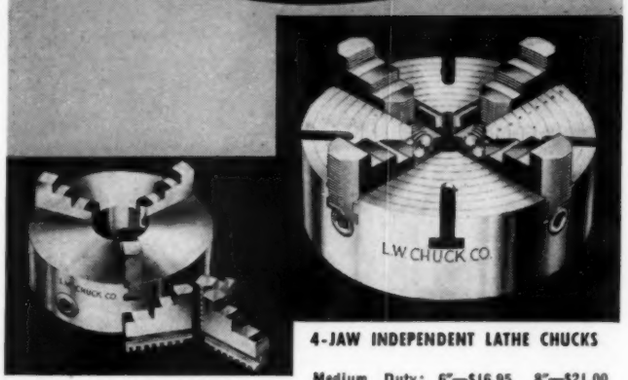

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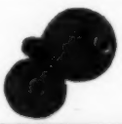

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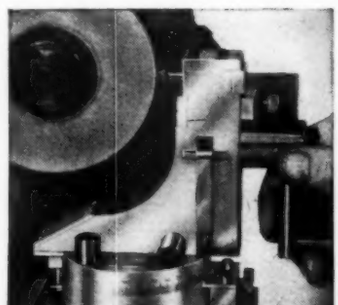

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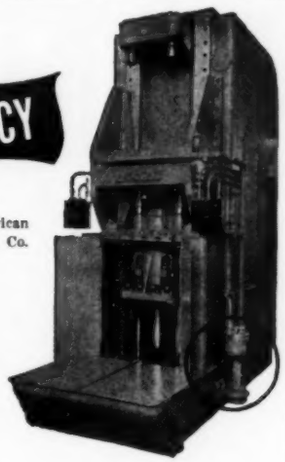

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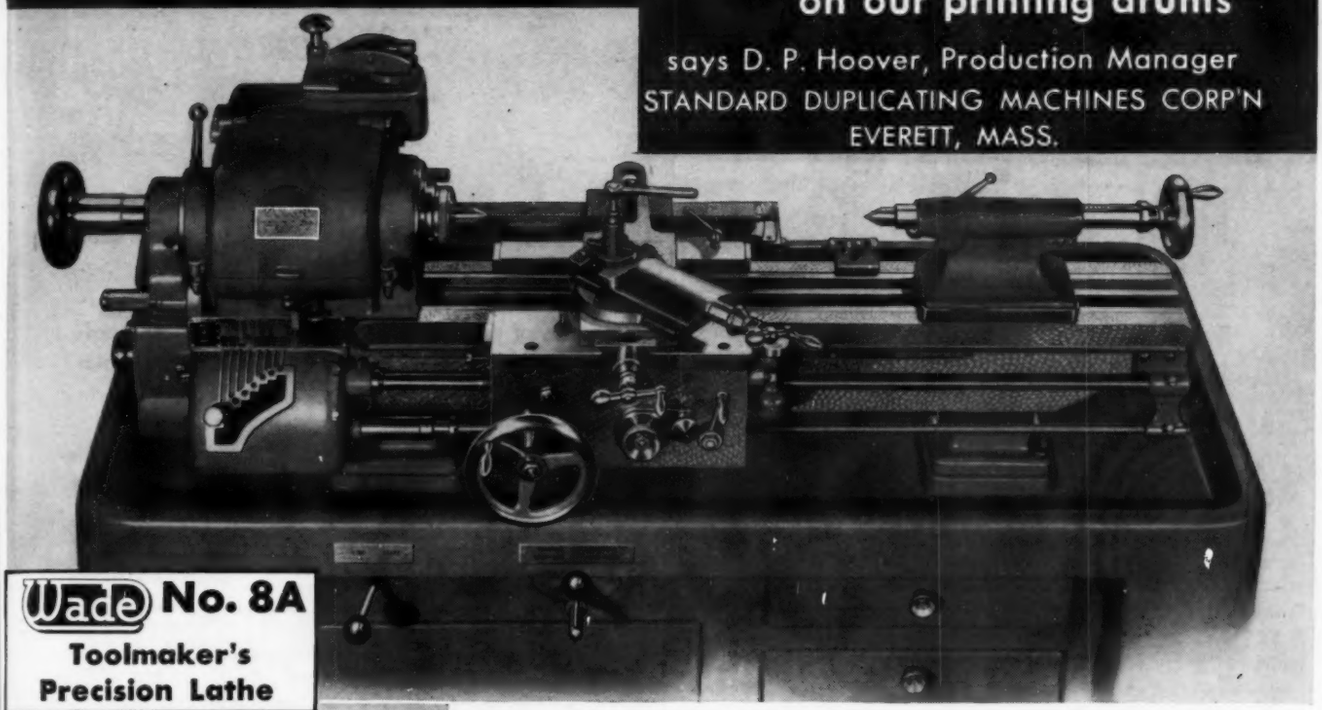
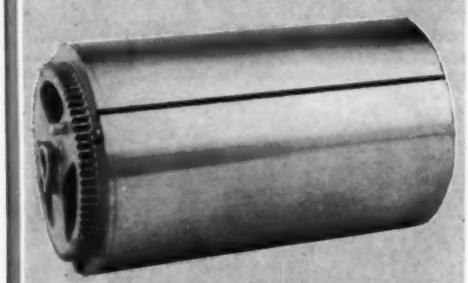
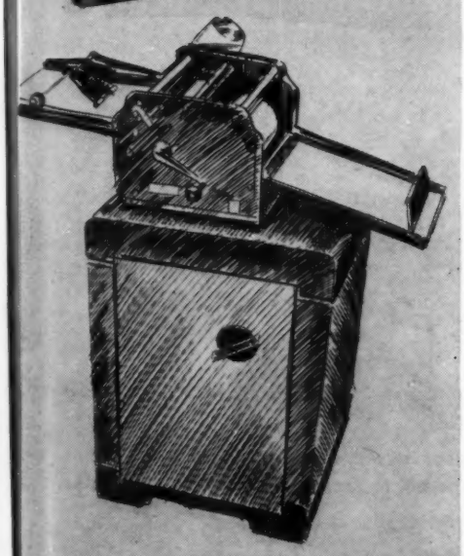


Wade No. 8A
Toolmaker's Precision Lathe





We had asked Mr. Hoover to tell us ***just why*** he preferred the Wade No. 8A Toolmaker's Precision Lathe for the finish operation on this drum. (He uses a less expensive, less accurate lathe of another make for roughing.) He told us that the 8A lathe has the ***speed*** and ***ruggedness*** he needs for high production output and a smooth surface, using tungsten carbide tools; and it has the ***precision*** that he demands for his final O.D., held to a tolerance of ± .002", and made possible through the rigidity of the spindle and the power of the drive.

One of the secrets of good printing reproduction on this low-priced fluid duplicator known as Model SWA is the great care used in casting and machining the zinc printing drum. This very efficient Standard Duplicator would fall far short of perfection with a poor drum, and we are proud that our No. 8A lathe is helping to maintain quality and speed up production at the Standard plant.

SPECIFICATIONS

Swing over Bed	8½"
Distance between Centers	24"
Collet Capacity	1"
Taper Standard for Centers	No. 2 Morse
Tailstock Spindle Travel	3¼"
Tool Shank Section	⅜" x ¾"

Write today for illustrated folder describing this very desirable Toolmaker's Lathe and its accessories

THE WADE TOOL CO., 53 RIVER ST., WALTHAM 54, MASS.

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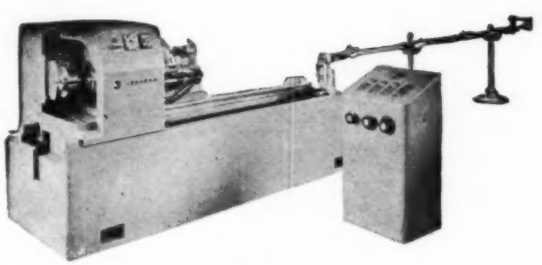
FOR USE WITH
WELDED TUBE ROLLING MILL



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- Travelling head is electrically oscillated and synchronized with the mill to insure cutting to accurate lengths.
- Can be readily installed on any mill.

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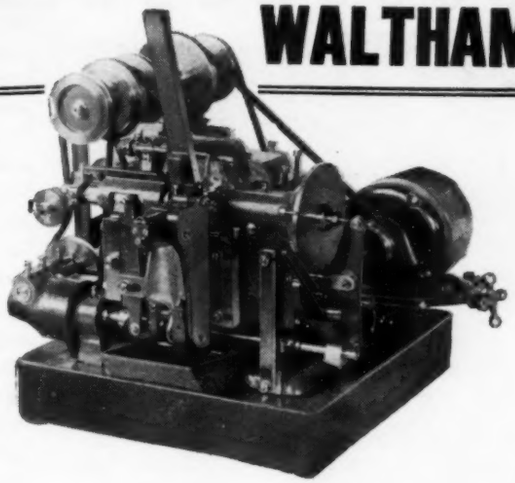
WALTHAM PINION and GEAR CUTTING MACHINES



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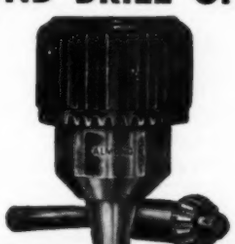

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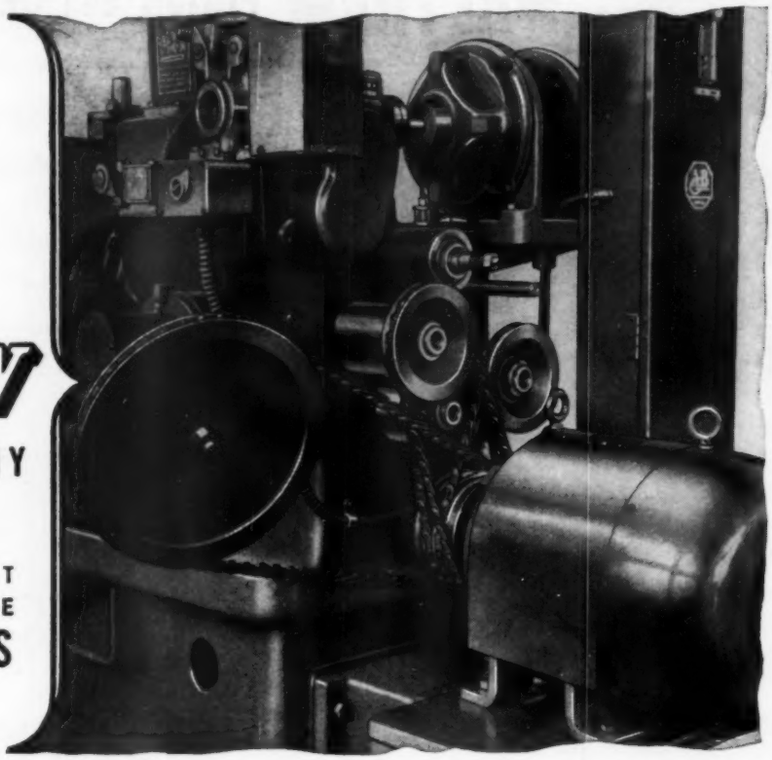

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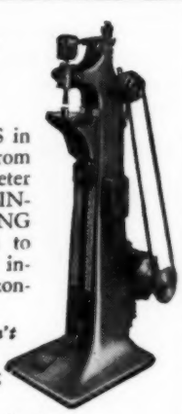

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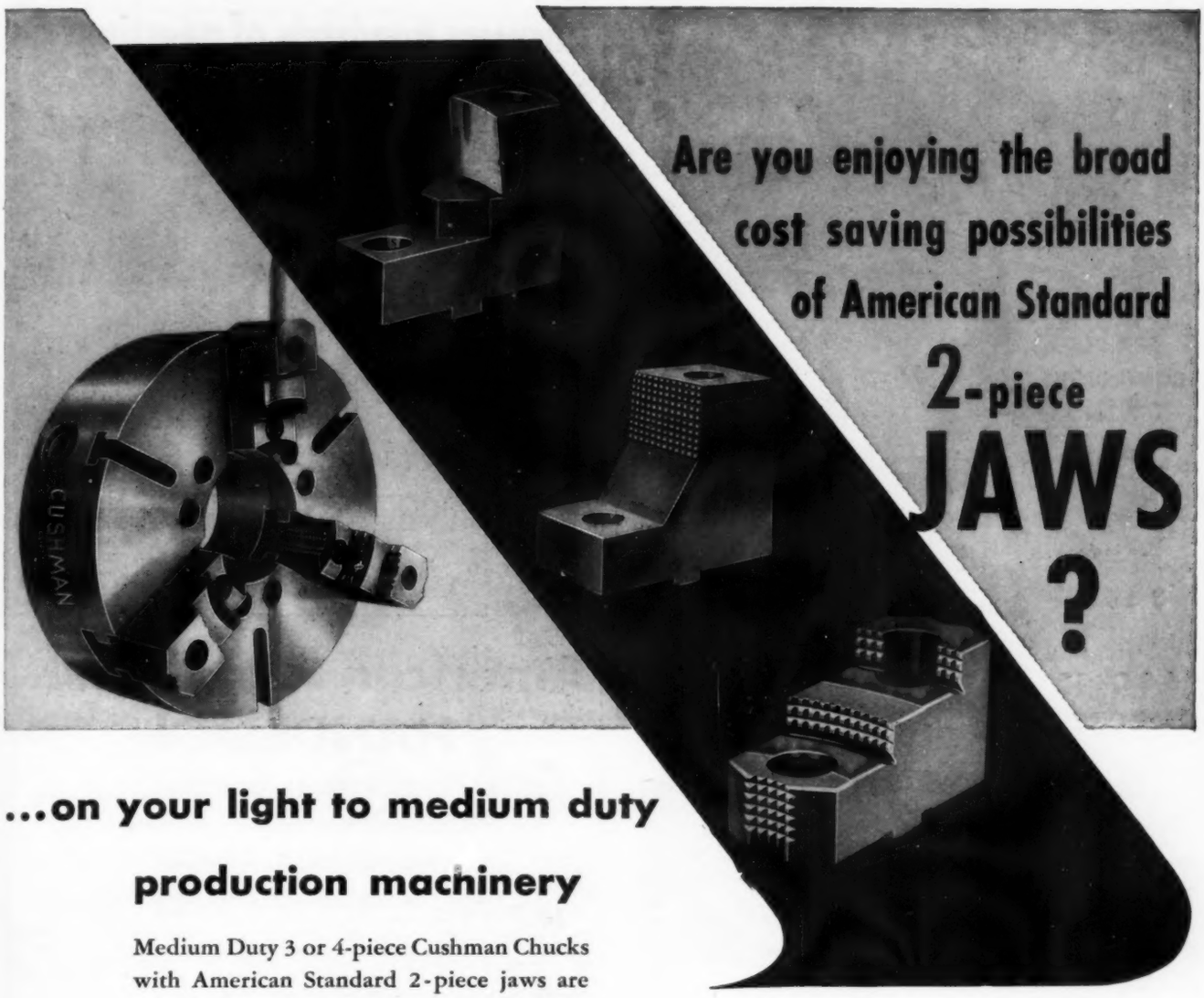

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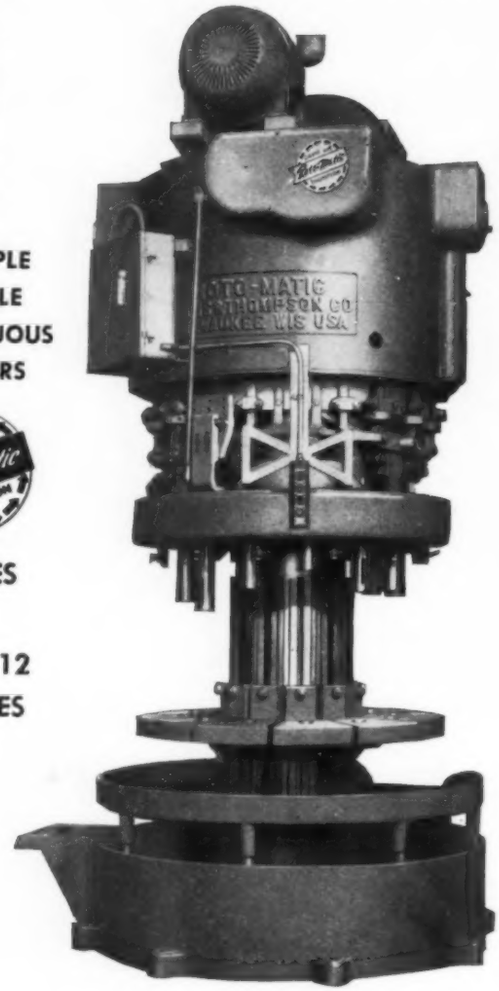

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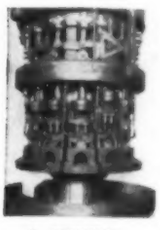

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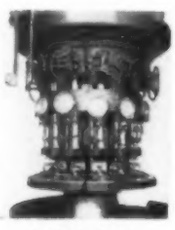

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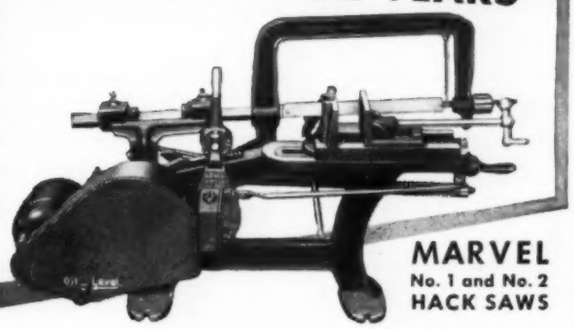

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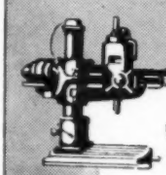

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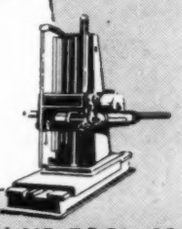

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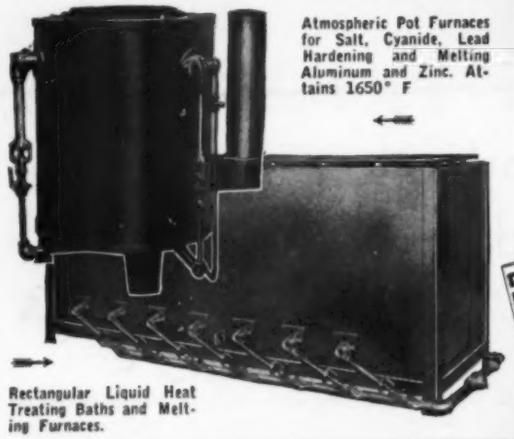

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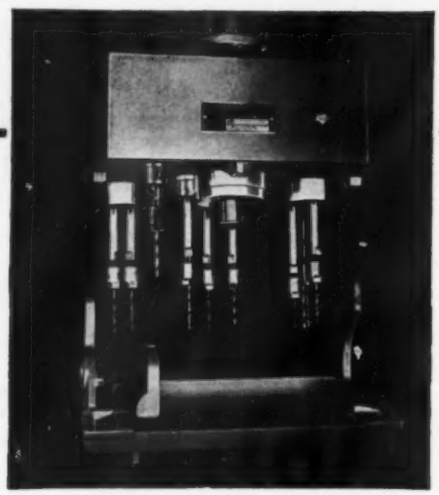

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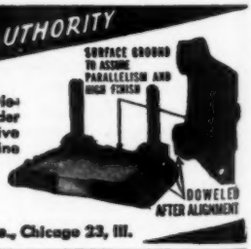

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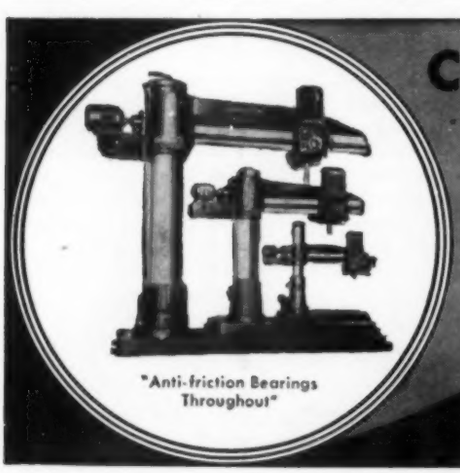

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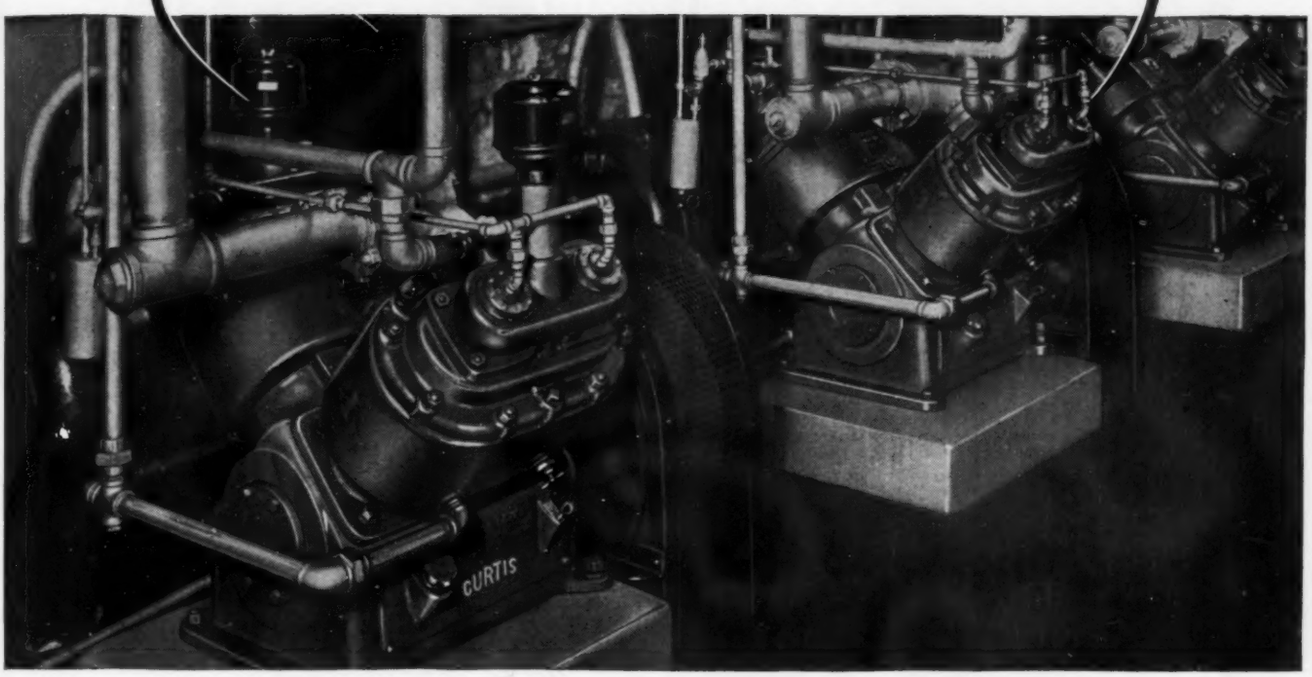

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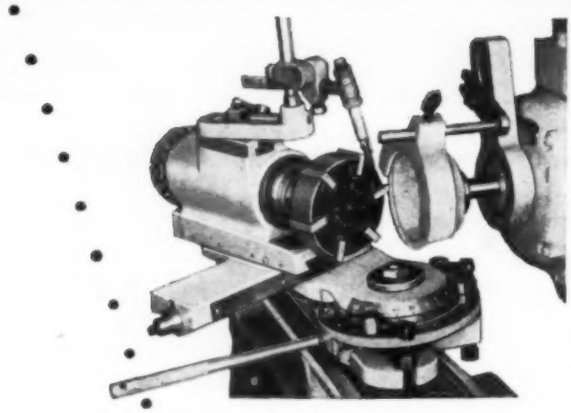

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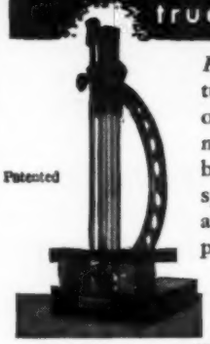

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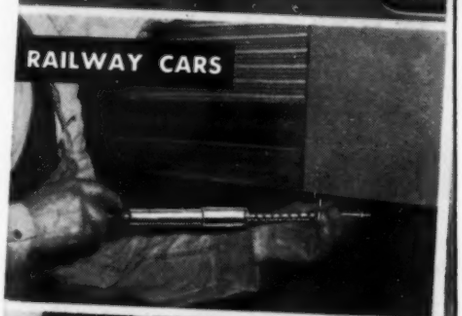

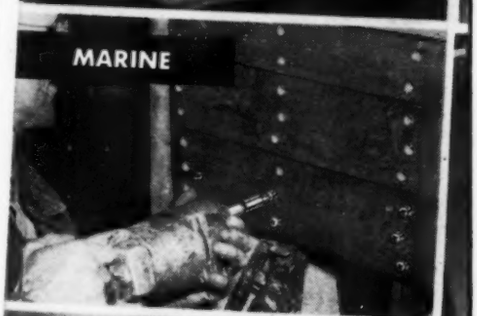

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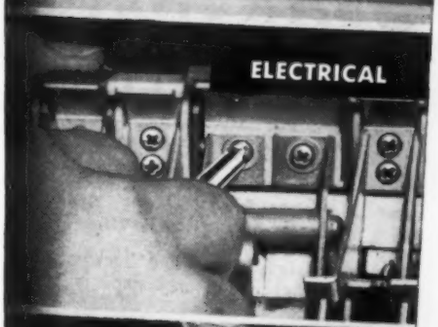

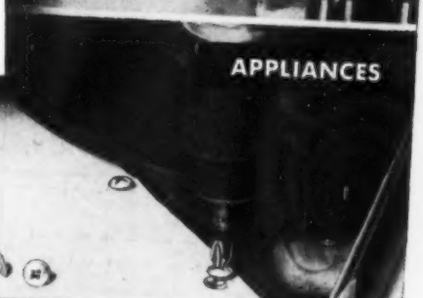

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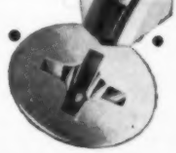

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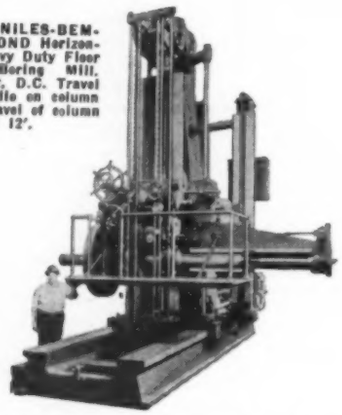

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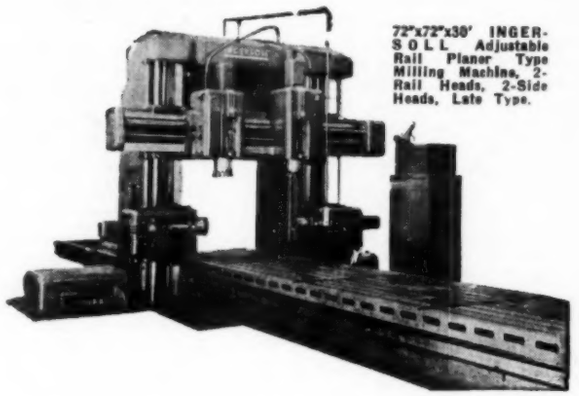

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CYLINDRICAL GRINDERS

Nos. 1 & 1½ LANDIS Grinders, M.D.
No. 4H LANDIS 4"x18" Plain Grinders
6"x18" NORTON & LANDIS Type C Plain, M.D.
6"x30" NORTON Type C Plain, M.D.
10"x18" LANDIS Type C Plain, M.D.
10"x72" NORTON Type C Plain, M.D.
12"x48" CINCINNATI Model ER Univ. M.D.
14"x36" LANDIS Type C Plain, M.D.
24"x96" NORTON Plain, M.D.

SURFACE GRINDERS

No. 2 REID Surface, M.D.
6"x10"x18" THOMPSON Type F Hyd. M.D.
14"x16"x60" THOMPSON Type C Hyd. M.D.
No. A3—16" Rotary, M.D.
No. 11 BLANCHARD Rotary, 16" chuck, M.D.

GRINDERS (Misc.)

No. 10 B&S Cutter & Tool, M.D.
No. 2 CINCINNATI Cutter & Tool, M.D.
No. 4T SELLERS Tool, M.D.
No. 72A3 HEALD Plain Internal, M.D.
9" P&W Hyd. Gear, M.D.
No. ND-10 HAMMOND Grinder, M.D.

LATHES

AMES Precision Bench Lathe, 1" cap., M.D.
No. 820 LOGAN QCG Lathe, M.D.
14"x30" cc LeBLOND Heavy Duty, M.D.
16"x30" cc MONARCH Model C Toolroom, M.D.
16"x78" cc AMERICAN "PACEMAKER", M.D.
20"x48" cc MONARCH Model M Engine (2)
50"x17' cc LeBLOND "BIG SWING", M.D.

MILLING MACHINES

No. 1M CINCINNATI Univ. Miller, M.D.
No. 2G KEMPSMITH All Geared Univ., M.D.
No. 2 HS CINCINNATI Dial Type Vert., M.D.
No. 2H KEARNEY & TRECKER Vert., M.D.
No. 4MS CINCINNATI Dial Type, Plain M.D. (2)

PRODUCTION MILLERS

No. 0B CINCINNATI Hor. & Vert. M.D.
No. 2-24 CINCINNATI Auto. M.D.
No. 1224 KEARNEY & TRECKER Simplex, M.D.
No. 1848 KEARNEY & TRECKER Simplex, M.D.
No. 12B P&W Two Spindle Profilers, M.D.
No. M50A TAYLOR & FENN Vert., M.D.
No. 45/48 CINCINNATI Plain Hydromatic, Tracer Control
No. 5/60 CINCINNATI Duplex Hydro tracer control mechanism for auto. rise and fall of spindle carriers, M.D.

TURRET LATHES

No. ESM-39 HARDINGE Hand Screw, M.D.
No. 0 B&S Feed Screw, M.D.
No. 2G MOREY Turret Lathe, M.D.
Nos. 3 & 4 GISHOLT Ram Type Univ., M.D.
Nos. 3, 4, & 5 WARNER & SWASEY Ram Type Univ., M.D.
Nos. 3 & 5 JONES & LAMSON Ram Type Univ., M.D.
No. 4A WARNER & SWASEY Saddle Type, Univ., M.D.

DRILLS

No. 263 BARNES Heavy Duty Upright Drill
20" BARNES "Camel Back" Upright Drill
Type MA-8 AVEY 4 spdle Floor Type M.D.
6-spdle ALLEN 5 power feed spindles, belted M.D.
3'9" CINCINNATI BICKFORD "Super Service" Radial
3'11" AMERICAN "HOLE WIZARD" Radial, M.D.
No. 3 Type MA-6 AVEY Single Spindle, M.D.

MISCELLANEOUS

LINDBERG Type HYT Tubulaire Hydryzing Furnace
Type B6 PORTER CABLE Belt Sander

WIGGLESWORTH MACHINERY COMPANY

203 BENT STREET Kirkland 7-5242 CAMBRIDGE, MASS.

UNUSUAL VALUES

Milling Machines—No. 1, Universal, No. 1 American (new) plain, No. 1 Vertical.
Drills—Large selection, single and multiple spindles also bench types, many of them new.
Gear Cutters—Brown & Sharpe No. 3—26", Gould & Eberhardt 42".
Grinders—Cylinder B & S No. 11, Planer type 16"x36", Surface 13"x63", also new (small) Universal bench and floor type. All with coolant, motorized.
Lathes—14"x6' 8', 10'—16"x6', 8', 10'—18"..6', 8' 10'—26"x16'—all cone drive, several motorized also (new) 18"x8' and 10' geared head, motorized.
Large stock 10" and 12" bench and floor type.
Planers—Single head 24"x6', 24"x8', 26"x8'.
Shapers—16", 20", 24", B.G. crank.
Turret Lathes—J & L 2"x24"—3'x36" also Acme, W & S Turret (vertical) boring and facing mills, 5 hole turrets, 30", 40".
SPECIAL—New totally enclosed dust ,proof, fan cooled, ball bearing saw arbor motors, plain shafts to size or threaded, and with collars, measures only 3¼" from center of shaft to flatted top (1 h.p. to 15 h.p.) 2 or 3 phase, 3600 r.p.m.
WOOD WORKING MACHINERY—A very large stock of new and re-built, practically all motorized. New Motorized overhead cut-off and miter saw for wood, plastics, steel, aluminum and other metals. The above list is only a fraction of our stock which changes almost daily, therefore, tell us definitely what you want since we are adding considerable number of machines to our stock which are too many to list. .What we have today may be sold tomorrow, so a list is really not dependable.
Drill—Foote-Burt No. 25 24" Hi Duty 3" capacity in steel, motor attached.
PATTERN MAKING MACHINERY—42"x 16' bed wood lathe, compound rest, rack and pinion feed to carriage; 16" heavy duty jointer, extra long bed, front table tilts for giving draft to pattern work; tilting able also tiling arbor rip and cut-off saws; band saws; jointer; floor and bench type trimmers; and also many other machines for pattern work.

THE OSBORNE & SEXTON MACHINERY CO.
P. O. BOX 88, COLUMBUS 16, OHIO

Bor Mill, Hor. 3" G and L, MD.
Boring Mills, 24"-36"-42"-52"-72"-96"
Drills, Radial 3'-4'-5'-6' Cin-Bick.
Lathe, Turret 3-A W and S, S.P.D.
Lathe, 36"x28' Betts, T.A., MD.
Millers, Plain No. 3 K and T, No. 4 Cin.
Millers, Vertical No. 3 B and S and No. 4 Cin.
Shaper, 16"-20"-24"-36".
Shaper, 36" Morton Draw Cut.

West Penn Machinery Company
1210 House Bldg. Pittsburgh, Pa.

SHEET METAL MACHINERY

NEW and USED—Hand and Power Brakes, Shears, Forming Rolls, Folders, Punches, Rotary Machines, Stakes, Spot and Arc Welders.

MONA MACHINES

B. D. BROOKS, INC.
361 Atlantic Ave., Boston, Mass.

THE LARGEST MACHINE TOOL PLANT IN THE U.S.A.

Eastern OFFERS FROM STOCK

DEVOTED EXCLUSIVELY TO REBUILT MACHINERY

AUTOMATICS

No. 4D Potter & Johnston, m.d., latest
No. 5B2E Potter & Johnston, m.d., latest
No. 5D2 Potter & Johnston, m.d., latest
4 spindle ⅞" Model R-4 Acme-Gridley, m.d.
4 spindle ⅞" Cleveland Model M, m.d.
1⅝" Conomatic 8 spindle, m.d.
4 spindle 2" Cleveland Model M, m.d.
4 spindle 2¼" Cleveland Model K, m.d.
2¼" Gridley Single Spindle, m.d.
2¼", 2½", 4¼", 4½", 5½", 6", 7¾" Cleveland Model A Single Spindle, m.d.
No. 6A, 6C Potter & Johnston, m.d.
14" Fay, m.d.
Jones & Lamson 20x25", m.d., late

HORIZONTAL BORING MILLS

2½" Cleveland, m.d.
No. 31 Lucas, m.d., 3" bar
No. 33 Lucas, m.d., 4½" bar
No. 45 Giddings & Lewis, m.d., 5" bar
4" bar Detrick & Harvey Floor Type, m.d.
4" bar Landis Floor Type, m.d.
4" Niles Table Type, old, m.d.
4½" Niles Table Type, m.d.
5½" bar Niles Table Type, m.d.
10" bar Sellers Floor Type, m.d.
72"x6' Ingersoll Single Horizontal Spindle Traveling Housing Milling Machine

VERTICAL BORING MILLS

24" Bullard New Era, m.d., with side head
36" Bullard New Era, m.d., with side head
36" Bullard Spiral Drive, m.d., with side head
36" Bullard Spiral Drive, m.d., coolant system, taper, side head, late type
42" Bullard New Era, m.d., with side head
42" Bullard Spiral Drive, m.d., with side head
42" Colburn H.D., m.d., 2 swivel heads
48" Cincinnati Rapid Production, m.d., 1 turret, 1 swivel head
48" Colburn H.D., m.d., 1 swivel, 1 turret head
48" Putnam H.D., m.d., 2 swivel heads
52" King, m.d., 2 swivel heads
54" Colburn, m.d., 1 turret, 1 swivel head, m.d.
84" Niles H.D., m.d., 2 swivel heads
100" Niles Extra Heavy, m.d., p.r.t., 2 swivel heads, late type
100" Niles Heavy, m.d., p.r.t., 2 swivel heads
120" Niles Heavy, m.d., p.r.t., 2 swivel heads

BOLT THREADING MACHINES

¾" Economy Style R Automatic Threading, belt, with Lanco Head
2 spindle 1¼" Landis, m.d.
3 spindle 1¼" Acme, belt

BROACHING MACHINES

No. 4 Oil Gear Hydraulic, m.d., type XA
No. 75 H.P. LaPointe Horizontal Hydraulic, normal pull 37½ tons, maximum stroke 150"
Cincinnati Mill Broach, m.d., 10" spindle, new
No. 4 LaPointe of Hudson, gear box

BALL BEARING DRILLS

Walker-Turner Bench Type, m.d., latest
No. ½, 1, 2 Avey, m.d.
No. 1B Edlund, m.d., new
No. 5M—16" Fosdick, m.d., tapping
Providence Model E, belt
2 spindle No. 3 Avey, m.d., p.f.
2 spindle No. 3 Avey, m.d., tapping
2 spindle No. 3 Edlund, m.d.
3 spindle No. 2 Motor Avey type MA6, p.f., latest
4 spindle No. 2 Avey MA 6, m.d., 2 tapping, latest
4 spindle No. 2 Avey, belted m.d.
4 spindle Gardam, belt

HORIZONTAL DRILLS

No. 1 Pratt & Whitney 2 spindle Deep Hole, m.d.
No. 1B—50" Pratt & Whitney 2 spindle Deep Hole, m.d., latest
No. 1½x105" Pratt & Whitney 2 spindle Deep Hole, m.d., latest
Pratt & Whitney Rifling Machine, belt
5 spindle Detroit Semi-Automatic, belt
Morris Horizontal Drill & Tapper, m.d., late

MULTIPLE SPINDLE DRILLS

No. 3 Baush, m.d., 16x30" head, bushed for 34 spindle, equipped with 15
No. 3 Baush, 20x40" head, as above
P7 Baush Hydraulic, m.d., 20x30" head
D13H Natco Hydraulic, 18x12" head, bored for 24 spindles
No. 16 Fixed Center Foote-Burt, m.d.
3 spindle 24" Barnes All Geared Self-Oiling, m.d.
3 spindle 12" Rockford Gang, m.d.
4 spindle Foote-Burt Rail, No. 4 Taper

RADIAL DRILLS

3'-9" American Triple Purpose, m.d. on arm
3' American Sensitive, belt
4'-13" American Triple Purpose, m.d. on base
4' American Sensitive, m.d. on arm
4'-12" Fosdick, gear box on base
4' Niles-Bement-Pond Semi-Universal, m.d. on base
5'-13" American Triple Geared, gear box
5'-15" American Triple Purpose, gear box on base
5'-13" Cincinnati-Bickford, m.d. on base
5' Cincinnati-Bickford Plate Hole Driller, m.d. on arm
5' Cincinnati-Bickford Full Universal, gear box
5' Prentice, m.d.
6'-15" Carlton, m.d. on base
6' extended to 7' Cincinnati-Bickford, m.d. on base
7' Dreses, gear box in base, 17" col.
6' Niles-Bement-Pond Semi-Universal, m.d.
6'16" Western, m.d. on base
8'-16" American Triple Purpose, m.d. on arm
8'-19" American Triple Purpose, m.d. on arm, late
100'-22" American Triple Purpose, m.d. on arm

UPRIGHT DRILLS

20" Barnes All Geared Self-Oiling, m.d., tapper
21" Cincinnati-Bickford Super-Service, m.d.
24" Cincinnati-Bickford, belt, tapper
24" Cincinnati-Bickford, belt
30' Rich, H.D., m.d.
H3 Barnes Hydram, m.d.
D4 Colburn H.D., s.p.d.
D8 Colburn H.D., s.p.d.
No. 36HO Baker, m.d., with 40" circular table
No. 217 Baker H.D., s.p.d.

GEAR SHAPERS

No. 6, 61, 645 Fellows, belt
No. 7A, 71A Fellows, H.S., m.d.
No. 18 Fellows Finishing Machine, m.d.
No. 61A, 615A, 65A3, 645A Fellows, m.d., latest type
No. 64-S Fellows, m.d.

GEAR GRINDERS

No. 13LS Fellows Lapper, m.d.
9" Pratt & Whitney Hydraulic Spur Gear Grinder, m.d.
10" Pratt & Whitney Hydraulic for Spur & Helical gears
No. 2HS Lees-Bradner Spur & Helical, m.d.

GEAR HOBBING MACHINES

Barber-Colman Model T, m.d., latest
No. 12H Gould & Eberhardt Universal, m.d.
No. 34 Brown & Sharpe Spur, m.d.
No. 44 Brown & Sharpe Spur & Helical, m.d.
No. 36H Gould & Eberhardt, with infeed for worm gears
48" Cleveland, m.d.

GEAR CUTTERS

3" Gleason Straight Bevel Gear Generator, m.d.
12" Gleason Straight Bevel Gear Generator, m.d.
No. 3—26" Brown & Sharpe Auto. Spur Gear Cutter, m.d.
No. 4—48" Brown & Sharpe Auto. Spur Gear Cutter, m.d.
No. 6—60" Brown & Sharpe Auto. Spur Gear Cutter, m.d.
No. 6—72" Brown & Sharpe Auto. Spur Gear Cutter, m.d.
8" Gleason Mfg. Type Straight Bevel, m.d.
11" Gleason Straight Bevel, m.d.
Gleason Spiral Bevel Gear Rougher, m.d.
Cincinnati Gear Burnisher, m.d.
No. 1 Brown & Sharpe Spur Gear Tester
Cross Gear Tooth Rounder, m.d.
National Broach & Machine Co. Red Wing Gear Speeder, m.d.
Gleason Gear Tester, m.d.

CENTERLESS GRINDERS

No. 2 Cincinnati, m.d.
Cincinnati Valve Seat Grinder, m.d., cap. ⅜" valve stems

CYLINDER GRINDERS

No. 50 Heald Hydraulic, m.d., new, 15" spindle, latest
No. 50 Heald Hydraulic, m.d., 18" spindle
No. 73 Heald Airplane Cylinder, m.d., new, latest

DISC GRINDERS

No. 4 Gardner, m.d.
No. 20 Gardner Comb. B.B. Disc Grinder & Roll Sander, m.d.
Standard Elec. Tool Co. 7½ H.P. Double End Disc, new
7½ H.P. United States Double End, new

PLAIN CYLINDRICAL GRINDERS

3x18" No. 5 Brown & Sharpe, m.d., latest
6x18" Cincinnati Hydraulic, m.d.
6x18" Landis Type C Hydraulic, m.d., latest
6x18" Landis, m.d.
No. 10 Brown & Sharpe, s.p.d.
No. 11 Brown & Sharpe, s.p.d.
6x30" Cincinnati Hydraulic, m.d.
6x32" Fitchburg Type A, m.d., latest
8x18" Cincinnati Saddle Type, m.d.
8x36" Cincinnati Saddle Type, m.d.
10x24" Landis, m.d.
10x36" Cincinnati Hydraulic, m.d.
10x48" Brown & Sharpe, belt
10x72" No. 16 Brown & Sharpe, belt
10x72" Landis, m.d.
12x36" Landis, m.d.
12x48" Cincinnati Self-Contained, m.d.
12x48" Modern, belted m.d.
12x96" Landis, m.d.
14x18" Cincinnati Self-Contained, m.d.
14x48" Cincinnati Self-Contained, m.d.
14x52" Norton, motorized
14x72" Cincinnati Self-Contained, m.d.
16x48" Landis Type D, m.d., latest
20x120" Landis Self-Contained, with gap, m.d.
26x96" Landis Self-Contained, m.d.

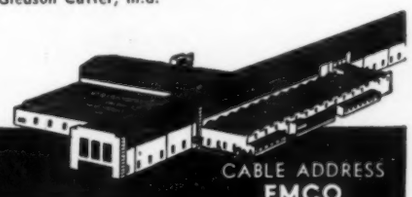
UNIVERSAL CYLINDRICAL GRINDERS

No. 1 Brown & Sharpe, m.d., latest
12x24" Cincinnati Self-Contained, m.d.
12x30" Brown & Sharpe, belt
12x30" Landis Hydraulic, m.d., late
12x36" Cincinnati Self-Contained, m.d.
12x36" Cincinnati, belt
12x48" Cincinnati Hydraulic, m.d., latest

TOOL & CUTTER GRINDERS

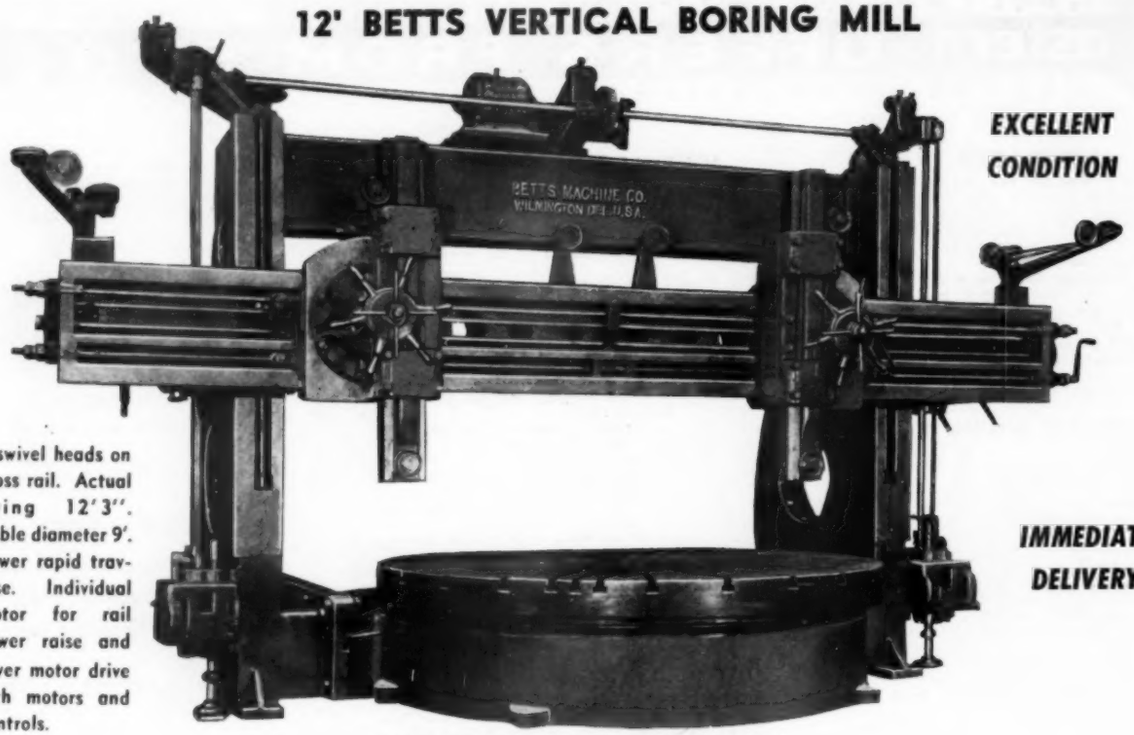
12x48" Cincinnati Self-Contained, arr. for jump grinding of splines
12x48" Norton Hydraulic, m.d., latest
16x48" Cincinnati, belted m.d.
18x48" Cincinnati Hydraulic, m.d., latest
No. 2 LeBlond, m.d., latest
Sterling Tool, m.d., latest
No. 3 Gallmeyer & Livingston, m.d.
Cincinnati Monoset, m.d.
Gleason Cutter, belt
No. 2B Sellers Drill, m.d.
No. 4T Sellers Tool, m.d.
No. 51 Oliver Drill, m.d.
Grand Rapids Tap, style 12M, m.d.
Gleason Cutter, m.d.

The ABOVE IS ONLY A PARTIAL LISTING. WRITE US YOUR NEEDS. LET US QUOTE.



THE EASTERN MACHINERY COMPANY
1004 Tennessee Avenue, Cincinnati 29, Ohio
MElrose 1241
CABLE ADDRESS EMCO

12' BETTS VERTICAL BORING MILL



2 swivel heads on cross rail. Actual swing 12'3". Table diameter 9'. Power rapid traverse. Individual motor for rail power raise and lower motor drive with motors and controls.

EXCELLENT CONDITION

IMMEDIATE DELIVERY

CAN BE SEEN IN OPERATION!!!

EMERMAN MACHINERY CORP.

875 W. 120th STREET — CHICAGO 43, ILL.

FOR SALE

#11 Cochrane-Bly saw and saw sharpener, with 7½ HP 220/440/60 motor, late model, good condition $1250.00

#PG-6 Ferracute punch press, geared 1¾" stroke, bed area R to L by F to B 34¾"x23", Opening inbed R to L by F to B, 16"x14". Slide adjustment. Ht. overall 103" $3400.00

#2 Cincinnati centerless grinder, filmatic spindle, ser. #2M-2HIL-9, late model $2350.00

#5012 Bliss press, 90 ton cap., adjustable ram, 5" stroke $2750.00

#35P Toledo punch press, gap type flywheel, 48"x 7", bed size 27"x18", stroke 1¾", 15" from bed to bottom of ram ways, 10 HP motor, Pitman strap and eccentric just rebuilt $1500.00

Hayes electric heat treat furnace, type HG64, with controls, ser. #3496 ..... $350.00

U. S. Multimiller, model MM-1-5-2, table 6"x2½", automatic vertical motion of spindle head 2", horizontal adjustment of spindle assembly 2¼" moterized, automatic lubrication system, Coolant pump and tank, little used late model $750.00

Pratt & Whitney upright shaver, excellent condition, model M-1257, ser. #537 ..... $550.00

Model RA-6 six-spindle Acme-Gridley automatic, 9/16" cap., inc. tooling and equipment, ser. #2237A, practically new $4550.00

6" Avey stock cutting band saw, late model, (exceptional machine) $475.00

Conveyor, app. 100 ft. in 8 to 10 ft. lengths ..... $3.50 per ft.

Presses, Waterbury-Farrel tapering, double crank, ram adjustment, 4" stroke, with cam gate knockout, 28" flywheel, not motorized, app. 25 ton cap. $375.00

BILLARD MACHINE & TOOL CO.

PHONE 44 — MANSFIELD, PA.

NEW SURPLUS

18" Height Gauges in Case complete ..... $45.00 ea.

Sets of 11 Pin Reamers #0 to #10, In Wooden Box ..... $7.50 pr. st.

Sets of High Speed Counterbores, from 6/32" to 1" for Allen Cap Screw Sizes: 6/32", 8/32", 10/32", ¼", 5/16", ⅜", 7/16", ½" ⅝", ¾", ⅞", 9/16", 1", 13 Counterbores in Wooden Box, ... $25.00 Set.

VICTOR MACHINERY EXCHANGE Inc.

251 CENTRE STREET

NEW YORK CITY

CANAL 6-5575

National Bent Shank Nut Tappers—Battery of ⅝" and ⅞" Machines.

2 Landis ¾" Bolt Formers and Threaders, M.D.

1 National ½" to 1" Hot Bolt Head Trimmer

Woodward & Powell 42"x42"x36 ft. 4 Head Planer

Cincinnati 36"x36"x16 ft. Planer, M.D.

1 Lodge & Shipley 36" Swing by 44 ft. Bed, Selective Geared Q.C. Lathe, M.D.

National Machinery Exchange

128-138 Mott St., New York 13, N. Y.

"WALSH" PUNCH PRESSES

Size	Stroke	Delivery
6 Ton	1¼" or 1½"	10 days
12 Ton	1½" or 2"	Immediate
18 Ton	2" x or 2½"	Immediate
20 Ton	2½" or 3"	Immediate
24 Ton	2" or 2½"	Immediate
28 Ton	2½" or 3"	Immediate
38 Ton	3", 3½", or 4"	Immediate
55 Ton	3" or 3½"	Immediate
65 Ton	4" or 4½"	Immediate

All Presses Complete with Drive, Motor, Counting and Safety Devices. Roll Feeds For All Presses. Two Weeks Delivery. Time Payments Arranged. Exclusive Distributors.

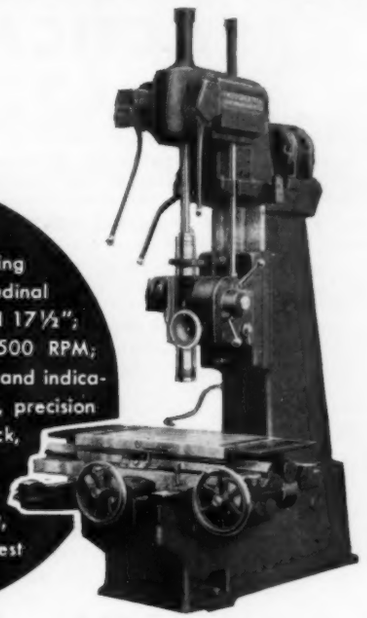
SCHULTZ & ANDERSON CO.

115 Edison Place, Newark, New Jersey

Tel. MArket 2-4318

Indianapolis QUALITY MACHINE TOOLS

PARTIAL LIST OF MACHINES NOW IN STOCK



Fosdick Jig Borer, Model 30, Table working surface 18" x 36", longitudinal table travel 30", cross travel 17½"; twelve speeds from 60 to 1500 RPM; equipped with measuring rods and indicators, 16" power rotary table, precision boring head, Jacobs chuck, collets, etc. Motor and control 3 phase 50/60 cycle, 220/440 volt, 1500/1800 RPM. Latest Model.

AUTOMATICS

2G Brown & Sharpe, H.S. 1½" capacity. New, 1943.
9/16" RA-6 Acme-Gridley. New, 1943.
1⅝" 6 Spindle Greenlee. New in 1942.
3½" RA-6 Acme-Gridley. New, 1942.
6" 4 Spindle Conomatic. New, 1942.
★**Bullard Multaumatic, six spindle Model D, single index. Late Model.**

BORING MILLS

No. 42 Lucas Horizontal, 4" bar, with rectangular revolving table, star facing head, motor and control. New, 1942.
★**Universal Horizontal 4" bar, table type, with facing head, rotary table, boring bars, motor and control. New, 1943.**

BROACHES

No. CPC 6-30 LaPointe Hydraulic Vertical. New, 1941.
No. CPC 6-36 LaPointe Hydraulic Vertical. New, 1943.

DRILLS

3' and 4' Dreses Radial, 11" column, enclosed head, 1938 model.
No. H3 Barnes Hydram, 8 speed. New, 1942.
42" Cincinnati-Bickford, single spindle.
KH 2 Allen, 6 spindle. New, 1943.
No. 3 Baush Multiple Spindle.
Barnes Horizontal Deep Hole, two spindle.

GEAR CUTTERS

No. 6 Gleason Gear Tester.
12" Gleason Straight Bevel Gear Generator. Late model.
No. 7A, 7125A Fellows Gear Shapers.
No. 615A, Fellows Gear Shapers.
No. 12 Barber Colman Hobber.

GRINDERS

No. TG615 Jones & Lamson Thread Grinder. New, 1943.
No. 2 & No. 3 Cincinnati Centerless, Filmatic spindle, 1941.
★**14" x 48" Cincinnati Universal, Filmatic bearing, internal spindle. New, 1942.**
No. 3 Brown & Sharpe Universal. New, 1943.
4" x 18" Landis, Type H.
6" x 18" Cincinnati, Filmatic Bearing.
10" x 72" Norton Cylindrical.
10" x 36" Landis Hydraulic. New, 1943.
No. 22 Heald Rotary Surface Grinder. New, 1943.
No. 18 Blanchard, 30" chuck. New, 1942.
16" x 16" x 48" Thompson Model C, Surface.
3B Abrasive, with chuck. New, 1943.
No. 5 Brown & Sharpe Surface. New, 1942.
6" x 12" x 18" Thompson Surface Grinder. New, 1942.
No. 2B Reid Surface, for wet grinding.
No. 16CP16 Bryant Hydraulic Internal Grinder. New, 1942.
No. 75A Heald Internal. New, 1943.
No. 72A3 & 72A5 Heald Internal. New in 1943.

LATHES, ENGINE

Hendey 12" x 30", g.h.
Reed Prentice, 14" x 30" g.h.
Lodge & Shipley Tool Room, 14" x 54", rel. att. New, 1943.
Reed Prentice 14" x 78" Toolroom. New, 1943.
American Pacemaker, 16" x 30". New, 1942.
Reed Prentice 16" x 54". New, 1943.
Sidney 18" x 54". New, 1943.
Lodge & Shipley 20" x 48". New, 1943.
★**Bertram 28" x 240" "Timesaver", two carriages, with rapid traverse. Canadian made from Niles patterns. New, 1942.**
American 30" x 20' g.h.
Lodge & Shipley 48" x 54", cone driven.
Carroll Jamieson 18" x 5', O.D.
South Bend 14½" x 6'. New, 1944.
Lo-Swing, models IMP and R.

LATHES, TURRET

Warner & Swasey No. 4A, with chuck, 7½" hole.
★**Warner & Swasey No. 2A, preselector, Cross sliding turret. New, 1943.**
Warner & Swasey No. 1A, preselector, cross sliding turret. New in 1942.
Jones & Lamson No. 9A. New, 1943.
Gisholt No. 2L, cross sliding turret. New, 1943.
Acme No. 1 Universal, saddle type. New in 1941.
Bardons & Oliver No. 7 Ram Type, Bar feed and tooling. New in 1942.
Foster No. 5 Universal, Bar feed. New, 1943.
Gisholt No. 4 Universal, Hydraulic speed selector.
Warner & Swasey No. 3 Universal. New, 1942.
Bardons & Oliver No. 3 Universal, motor in base. New, 1941.
Warner & Swasey No. 2, oversize. New, 1942.
Bardons & Oliver No. 2, bar feed. New, 1941.
Bullard, 36" Spiral Drive VTL. New, 1943.
Bullard 42" New Era, VTL.

MILLS

★**Cincinnati No. 4 Universal, High Speed Dial Type with rotary table, vertical attachment, slotting attachment, dividing head, motor and control. New, 1942.**
Cincinnati No. 2M Universal.
Brown & Sharpe No. 2A Universal. Late Type.
Brown & Sharpe No. 1 Universal. New 1941.
Kempsmith Maximiller Plain, No. 3.
Brown & Sharpe No. 3B Plain. New, 1943.
Brown & Sharpe No. 2B Plain.
Cincinnati No. 2MH Plain, latest model.
Cincinnati Hydrotel 28" x 60", depth & tracing.
Milwaukee No. 3H Vertical. Latest model.
Milwaukee No. 2K Vertical. New, 1942.
Cincinnati No. 2 Vertical. New, 1940.
Cincinnati No. 08 and 2-18 Rise and Fall.
Cincinnati No. 1-12 Automatic.
Cincinnati No. 3-36 Hydromatic.
Cincinnati No. 34-36 Hydromatic High column with Hydrotel.
DeVlieg Supermill No. 31B.
Brown & Sharpe No. 12. New, 1942.
Whitney Hand Mill, No. 6.

MISCELLANEOUS

Jones & Lamson Comparator.
Cleveland Rigidturner, No. 616.
18' x 18" Marvel Hydraulic Saw.
18" x 18" Racine Hydraulic Saw.
12" x 12" Peerless High Speed Saw.
Bertsch 6' x ½" Bending Roll.
No. 26F Norton Hydrolap.
No. 5B Standard OBI Press. New.
No. 8-6 Zeh & Hahneman S. S. Geared Press.
Toledo No. 41 Horn Press.
Tapper, Leland Gifford 3' Radial, No. 3 M.T. New, 1941.
24" Cincinnati Worm Feed Rotary Table.
Dodds Dovetail Machine, 15 spindle.

PLANERS AND SHAPERS

Cincinnati Planer, 42" x 42" x 20', Four heads D.C.
Cincinnati Planer 52" x 36" x 40' four heads, box table. D.C. motor drive.
6" Ammco Bench Shaper.
Cincinnati 24" Shaper, Universal table and power down feed. New, 1943.
Smith & Mills 28" Shaper.
Cochrane & Bly No. 14 Vertical Shaper. New, 1942.
Pratt & Whitney 6" vertical shaper. New, 1943.

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(1) No. 8-D GORTON UNIVERSAL VERTICAL MILLING MACHINE, Serial No. 15634. PRICE.....$1,750.00

(1) No. 9-J GORTON UNIVERSAL VERTICAL MILLING MACHINE, Machine Built in 1945, Three Months Actual Service. PRICE $3,750.00

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(1) 200 TON HYDRAULIC STRAIGHTENING PRESS. Mfg. by Hydraulic Press Co., Length of Bed 240", Width 24", Clearance Between Rods 30". PRICE.....$4,500.00

(1) HANNIFAN 125 TON CAP. HYDRAULIC PRESS, Stroke 22", Ram 6", Bolster Plate 36"x51", Bed 76½"x56½", Serial No. A-67-158. PRICE $3,500.00

(1) No. 35-L EXCELLO PRECISION THREAD GRINDER, Serial No. 1458. Mfg. in October, 1943. PRICE.....$3,500.00

(1) No. 33 EXCELLO THREAD GRINDER. Serial No. 4714, Mfg. in 1943. PRICE.....$3,000.00

(6) PRATT & WHITNEY 9" GEAR GRINDERS. PRICE ...$1,000.00 ea.

(5) DETROIT GEAR GRINDER, MODEL GG-19. PRICE ..$1,150.00 ea.

(2) TURCHAN FOLLOWERS FOR 36" BULLARD BORING MILLS. PRICE .....$1,000.00 ea.

(2) 2-25 TON BLISS DUPLEX PRESSES. PRICE.....$850.00 ea.

(2) HEALD INTERNAL GRINDERS, #72-A. Serial Nos. 13939 and 13940. PRICE.....$1,500.00 ea.

(1) GISHOLT No. 4-R SADDLE TYPE TURRET LATHE, Serial No. 2914-37, with 26" 4 Jaw Chuck 9" Hole in Spindle, 4-Way Tool Post. PRICE.....$4,500.00

(2) WATSON-FLAGG THREAD ROLLING MACHINE. Mfg. in 1943 by Watson-Flagg Machine Co. Dia. of Thread 3/16"-2½", Length of Thread up to 2¾", Model No. 25-2500, Serial No. 24896. PRICE .....$2,000.00 ea.

(1) No. 4-36 CINCINNATI PLAIN HYDROMATIC MILLING MACHINE Mfg. In 1943. Serial No. 3B41P1K-22. PRICE.....$3,250.00

(1) 6" CONO-O-MATIC, FOUR SPINDLE. Serial No. 4487 KK, Complete with Chip Conveyor, Full Set of Gears, Collets, Pads. Large Amount of Tooling, New in 1942. PRICE $13,500.00

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OFFERS:

Landis—16" by 72" Plain Cylindrical Grinder. Hydraulic feed to table 220/440/3/60 voltage. Used 11 months.

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BARGAINS!

SURPLUS EQUIPMENT

BRIDGEFORD 36x24' Centers Engine Lathe, Motor Drive

BULLARD 16" 6 and 8 spindle Mult-au-matic Type D Single Indexing, New 1943

CRANES from 5 to 30 ton capacity all 230 volts, DC current

JONES & LAMSON "Fay" 20x25 Centers Production Lathe, New 1941

LODGE & SHIPLEY 36x144" centers Engine Lathe, Motor Drive

LoSWING 8x108" Centers Production Lathe, New 1941

NIAGARA 1000, 1200 KVA Transformers, New 1941

NILES 30x50' Bed Boring Lathe, New 1941

NILES 72x63' Centers, Combination Boring and Turning Lathe, Motor Drive

WORTHINGTON 3½"x18" Horizontal Duplex Pump Type HDDA; 270 G.P.M., New 1944

This is a partial listing. More than 1,000 other items for immediate delivery. Our prices cannot be duplicated. We Solicit your inquiries.

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MACHINERY

LATHES

25"x16' LeBlond. Gear Head. T.A.
U. S. Mod. 95 Pol. Lathes
12"x30 Pratt & Whitney Tool Room Lathe
5"x18" Monarch Production Lathe, 20"x16' G. H. Taper Att.
Lodge & Shipley Duomatic 3A
#4 Warner & Swasey Bar Feed
#3 Bardons & Oliver Hand Screw Machine
#2 Simmons Hand Screw Machine
#3 Warner & Swasey Air Chuck
#3 Gisholt Air Chuck

MILLS

No. 4 Cincinnati Horizontal
2MH Cincinnati Horizontal Mill
No. 4 Horiz. Kempsmith Maximiller

GRINDERS

Norton 12x48 Univ.
14"x72" Norton, Pl. Cyl.
14"x72" Cinn., Pl. Cyl.
No. 2 Cinc. Centerless, Filmatic Brg., (NEW) with Bar Feed.

PRESSES

200 Ton Consolidated #67A
250 Ton Baldwin Southwark Hyd. Platen 12'x4'.
Cleveland 10S, Str. Side, Air Cushion, M.D.
40 Ton O.B.I., Dble Crank, 40"x17" Bed.
No. 1 Manville SS, 20 Ton.
No. 2 Manville SS, 15 Ton.

SHEARS

Bertsch 12'x¼" Cap.
Niagara ⅜"x62"—18" Gap. M.D.

SCREW MACHINES

New Britain Model 412 Chuckers
New Britain Model 656 Chuckers.

SHAPERS

16" American Universal.
#5 Mitts & Merrill Keyseater.

MISCELLANEOUS

100HP Ingersoll-Rand Air Compresser.
Hammond Automatic Buffer, Model SB-6.
4 N Nazel Dobdel Forging Hammer.
Model 101 Production Tube Polisher.
Climax Wire Straightener No. 2.
DeLavel Oil Centrifuge & Chip Separator.

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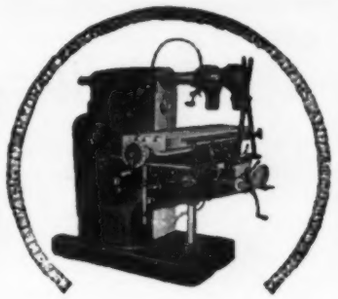
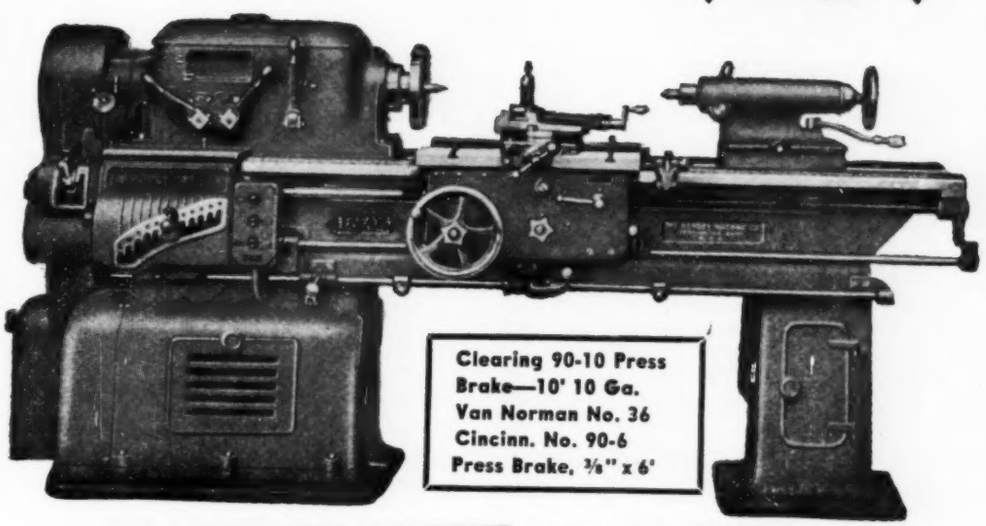
Cleveland 14, Ohio

AARON VALUES IN MODERN TOOLS





Clearing 90-10 Press Brake—10' 10 Ga.
Van Norman No. 36
Cincinn. No. 90-6
Press Brake, ⅜" x 6'

SCARCE LATE MACHINES

Consomatics 6 spdl. 2⅝", 1½" late, fully equipped.
NBP 2500 lb. Single Frame Steam Hammer
Ferracute D.D.G. 56, 105 ton Double Action Cam Press.
Universal 3" boring mill
Gorton Duplicators and Vert. Millers, 8D, 9J
Gorton No. 3Z, Engravers
Marvel 6A Hacksaw, M.D., Auto. Feed
Injection Moulders, Hydraulic Presses
Thompson 6 x 18" Hyd. Surf. Grinder
Bakewell No. 1 Tapper
Abrasive 6x18, 8x24 Surface Grinders No. 3B, 34
Conomatic 1⅞" 8 spindle
Brown & Sharpe #5 Grinder Cyl.
Tannewitz Di-Saw #36M
Thompson Seam Welder
Mod. 20 Rafter, New 1945
W & S Nos. 3, 4 Grd. Hd., Pre-selecter
Gisholt No. 5, 2L Univ.
Cinn.-Bickford 3'9" col. Radial
Acme #2 M.D., Foster 3B
Oliver 20" Woodworking Planer
Oster 601 Rapiduction, Tooling
Hardinge ESM, 2nd operation
Cincinnati 12x36" Univ. Grinder
No. 18, 25 and 35 Gallmeyer and Livingston Hyd. Surface Grinders, 6x18, 8x24
#25A Heald, M.D., like new Rotary Surf.
Cinn. #2 Centerless Grinders Filmatic
B & S No. 2, 2B Surface, M.D.
Norton 6x18" Hyd. Surface. M.D.
Covel #91A Tool, & Cutter
Hammond & Excello Carbide Grind
Gardner #226 Disc
Monarch EE 10"x20" Lathe
Hendey 12x30, G. H. Lathes
Morey No. 3 Univ. Turret Lathe
South Bend, M.D. 9x3½", 10x48', 13"x5'
Sebastian 12"x4' grd. hd.
Rivett No. 918 bench M.D.
Hardinge Cabinet Lathe
Lodge & Shipley 16"x78" 12 speed Grd. Hd. lathe
Buffalo #0 Angle Roll, M.D.
Bliss #58.0B Gap Presses 62, 62A, 162
Burke Miller Pl. & Univ.
Nichols Hand Miller, Vert. Hd.
Delta Single & Multiple Drills
Oliver Heavy die Filer, 510 Drill Pointer
J & L bench comparator 14"
Taylor Winfield 50 KVA Spot Welder
Peerless No. 226, Eyeletting
Hi Speed Hammers, all sizes
Cinn. #3 Pl., #4 Vert. Dial Type, Rect.
B. & S. #12 Elec. Prod. #21
Waterbury-Farrell #30 Thread Roller & Dies
Cinn. Bickford 24" Super Serv.
V & O 102 Reducing Press
V & O, Z & H 25, 35, 75 Ton OBI
Cinn. I-12, 2-18 Production Mills
Pratt & Whitney 1 & 2 spindle Profilers
Stokes Tablet Press
Ball & Jewel Plastic Grinders
20"x30' Boye & Emmes Grd. Hd., Lathe

BORING MILLS

#0 Giddings & Lewis arr. M.D.
2½" Cleveland arr. M.D., 2½", 4" Binsee
Niles-Bement-Pond 4" duplex
66" Niles, 2 hds.
Bullard New Era 24", 42", King 42"

NEW IN STOCK

Power & Gap Shears—52", 72" & 96"

Spot & Arc Welders, 6x6" Racine Hacksaw
5, 7, 14, 18 & 30 ton OBI Power Presses
Ammco 7", Shape Rite 8", Shapers
H.S. Vertical Milling Heads
Drill Presses, Foot Presses
Kalamazoo Metal Band Saws
No. 1½ Abrasive Wet Surface Grinder
20 ton Northern Hydraulic Presses
10Z & 20Z Injection Moulders
Famco 6C Arbor Presses—½ Price

TURRET LATHES

Foster Nos. 4, 5, 6, 1B, 3B, M.D. Univ.
J. & L. 2"x24", 3"x36"

GRINDERS

Surface Grinders, 6x18, 8x24
P. & W. 14", B.B., Vert. Surface 19"x49"
Blanchard 30", M.D.; Modern 12x48" M.D.
Norton Hydraulic 12x18", M.D. Cyl.
Heald No. 72A3 Gagematic
Norton 50"x28' M.D. Roll Grinder
Landis Type A 6x20" Hydraulic, M.D. Cyl.
No. 55, 60, 65 Heald Int., M.D.
12" Heald Rotary, Arter 12" M.D.
B. & S. No. 10, 11, Cyl.; 1, 3 Univ.

LATHES

Hendey 12x30, G.H. Lathes
26x12' Boye & Emmes 3 step cone D.B.G.
14"x6' Hendey Taper, Collets 16"x8'
9" LeBlond, P&W 1"x18" Automatic
36x30' Putnam M.D., 36x22', 42x16
32"x35' Wickes, M.D.
Wade, Hjorth, Hardinge, P & W Precision Bench

AUTOMATICS

Cleveland Model A ⅞", 1¼", 2"; B 1", 2", ⅞"
Cone 4 spindle, Gridley
Brown & Sharpe #4, 6 Auto., #2 Hand

MISCELLANEOUS

Clark, Rockwell Hardness Testers
Pexto 3' to 8' Shears & Brakes
Gorton 1A; 375-2 Tool & Cutter Grinders
Wiedman Turret Punch—Type R4P
6" Vertical Shaper, P & W
10x10 Peerless Universal Shaping Saw
#7, 72 Fellows Gear Shapers
Pexto 6' Power Shears
Deckel G1, G2, GIF Engraving machine
Hanson Whitney Thread Miller, Planetary
Leland-Gifford 1, 2 & 4 spindles, Model MS

M Geo. Ohl 8' 16 Gage M.D. Shear
N.B.P. 2500 lb. Steam Hammer

HYDRAULIC EQUIPMENT

2000 TON BIRDSBORO PRESS

Self Contained

60" between rods left to right, 53" front to rear. Overall length of platen left to right 144". Stroke 30". Opening 36". 60 H.P., 3 phase 60 cycle, 220-440 V motor.

1000 TON H.P.M. PRESS Self Contained

Platen 72"x48". 36" stroke. 36" opening 40 H.P., 3 phase, 60 cycle, 220-440 V motor.

500 TON LAKE ERIE PRESS

Platen 35"x36", 36" stroke, 68" opening, 150 H.P., 360-440 V. Motor.

35 TON VERSON PRESS

40x40 platen, 36" stroke, 50" opening. 100 H.P. 3 phase—60 cycle 440 volt.

400 & 500 TON SHAFT STRAIGHTENERS, Self Contained.

All Hydraulic equipment is completely engineered and checked by a competent staff, thus assuring reliability. Send us your hydraulic problems.

MILLING MACHINES

3B K. & T. Dbl. Overarm
Cleveland Vert. No. 1 M.D.; #1 Univ.
#2B K & T Univ.; No. 2A B & S Univ.
No. 3S Cincinnati, S.P.D. rapid trav.
Nos. 0Y, 2, 3, 4, 5 B & S Plain & Univ.
Hall Planetary Model D Thread Miller
Becker Nos. 3, AB, 5, 6 Vert.
Nos. 2, 3, 4 Cincinnati Vert.
P. & W. No. 12, 30" Profiler, M.D.
B. & S. No. 1, 3 Vert.
Taylor-Fenn Spline Miller

RADIALS

Carlton 8' Arm 19" col. M.D.
6' Cincinnati-Bickford
4', 5', 6' American Triple Purpose
Walker-Turner, ½" cap.

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EVERY MACHINE TESTED AND GUARANTEED AS REPRESENTED

LATHES

SOUTH BEND, 14"x6', 16"x10', 10"x3½'
BRADFORD, 14"x6', 16"x6', 16"x8'
CARROL-JAMIESON, 16"x6', taper attach.
PUTNAM, 28"x12', M.D.
CLAUSING, 12"x5', M.D.
HENDEY, 16"x6', 16"x8', taper attach.
RIVETT, No. 608 taper attach. precision
LE BLOND 24"x15', M.D.
BRIDGEFORD, 26"x34"x17', taper attach.
LE BLOND 'REGAL', 13"x5', 17"x6', 17"x9'
HARDINGE, 1" cap. second operation
ELGIN & HARDING PRECISION, 1" cap.
PRATT & WHITNEY, 10"x20", precision
PRATT & WHITNEY, 13"x6', taper attach.
SIDNEY, 18"x10', taper attach.

TURRET LATHES

GISHOLT, #3 bar equip. preselector
GISHOLT #1L, air cylinder
WARNER & SWASEY, #1A chucking
FOSTER, #5 universal, bar feed
SIMMONS MICRO-SPEED, 1¼" cap. bar feed
WARNER & SWASEY #1, ⅝" cap.
BROWN & SHARPE, hand screw, #0, #1

GRINDERS

BROWN & SHARPE, #2 universal
BROWN & SHARPE, #13 universal
COVEL, #91A, tool & cutter universal
CINCINNATI, #2 centerless, Filmatic
LANDIS, cylindrical, type H, 4"x12"
CINCINNATI, cylindrical, 6"x18", FILMATIC, HYD.
HEALD, #72A3, plain internal, HYD.
BLANCHARD, VERTICAL SURFACE, #16, 26" chuck
BLANCHARD, VERTICAL SURFACE, #11, 16" chuck
ABRASIVE, VERTICAL SURFACE, #33, 8x24"
MATTISON, SURFACE, 14"x16"x60", hyd.
BROWN & SHARPE, #5 surface, hyd.
THOMPSON, SURFACE, 6"x18", hyd.
BROWN & SHARPE, SURFACE, #2B
REID, SURFACE, #2B, #2-3, Pope spindle
Excello Thread Grinder #31
Jones & Lamson Thread Grinder, 12"x45"

SHAPERS

Cincinnati 24" latest heavy duty
American 21" M.D.
Gould & Eberhardt, 16" M.D.
Stockbridge, 16", M.D.
Pratt & Whitney, Vertical 6", M.D.
Atlas on steel bench 7", M.D.
Shaperite floor model 8" NEW

DRILL PRESSES

American Radial, 4'x11" column
Avey, 2sp. #MA6, #3 taper
Buffalo, 2sp. #22, #4 taper
Avey, #2 single spindle, 15" overhang
Leland-Gifford, #2, single spindle
Allan, 6 spindle, #2, 12" overhang
Champion 24", backgeared, #4 taper
Natco, multi-spindle, #D5
Canady-Otto drills 4sp. NEW
Canady-Otto, 17" Roller bearing

PLAIN MILLERS UNIVERSAL

AMES, UNIVERSAL, PRECISION, BENCH
BROWN & SHARPE, #3A, UNIVERSAL
BROWN & SHARPE, #3B, PLAIN
BROWN & SHARPE, #3, UNIVERSAL
CINCINNATI, #2MH, Universal
KEARNEY & TRECKER, #1B, S.P.

VERTICAL MILLERS

CINCINNATI, #3, #4, dial type
VAN NORMAN, #3V, rapid traverse
KEARNEY & TRECKER, #2KM, dial type
KEARNEY & TRECKER, #3KM, dial type
KEARNEY & TRECKER, #3H, dial type
BRIDGEPORT, POWER FEED to table

PRODUCTION MILLERS

PRATT & WHITNEY thread miller, 4½"x12"
WALTHAM thread miller, ext. & int.
CINCINNATI, #4-48 hydromatic
CINCINNATI, #1-12 automatic
KEARNEY & TRECKER, #1H-18 Mfg. type
SUNDSTRAND, #2 Electromill, 24" travel
BROWN & SHARPE, #000, high speed

GEAR MACHINERY

BARBER-COLMAN, MODEL, 8, Bench
HAMILTON, SWISS-TYPE, #1 hobber
FELLOWS, #61A, spur gears
GLEASON, 18" cap. straight bevel
GOULD & EBERHARDT, #735, spur gears

AUTOMATIC SCREW MACHINES

BROWN & SHARPE, #2G, 1½" cap.
BROWN & SHARPE, #0G, ⅝" cap.
BROWN & SHARPE, #2, high speed
BROWN & SHARPE, #2, with slotter
BROWN & SHARPE, #00, high speed ⅜" cap.
New Britain, #61, 2¼" cap.

BOREMATICS

Excello #2112A, double head
Heald #48A, double head used 2 weeks
Heald #48A, single head

PRESSES, SHEARS, BRAKES

Niagara #310, 10'x16 gage NEW
Niagara 6'x10 gage, 16" gap
Verson 6'x45 ton cap. press brake
Fameo Shears, 36", 52" NEW
Consolidated Press #3, tie rod, M.D.
Ferracute Press #C3, inclinable
Double Crank Press, 40 ton cap.
Zeh & Hahnemann, 10 ton roll feed
Erie hydraulic 750 ton like new
Diebel Hi-speed and roll feed
Hydraulic Press 25 ton to 750 ton

MISCELLANEOUS

Baker Keyseator #1, M.D.
Riveting Hammers, high speed #1½B, #5A
Spot Welders 5 KVA to 100 KVA
Fameo Foot Presses, #6, #8, #10, #12, #15
BUTTERFLY Filing machines
Porter Cable belt sanders
Flexible Shaft Grinders
Machinery for Sheet Metal trade

THIS IS A PARTIAL LISTING—TREMENDOUS STOCK ON HAND—YOUR INQUIRIES WILL RECEIVE OUR PROMPT AND COURTEOUS ATTENTION.

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MDNA MEMBER

HEADLINERS

LATHES

14"x6' HENDEY Yoke Head, AC self-cont. drive, univ. relieving attach.
14"x6' AMERICAN 12-speed Grd. Hd. AC MIB, taper
14"x8' AMERICAN 12-speed Grd Hd, AC MD, taper
17"x8' SIDNEY, Lima Drive, taper
18"x6' LODGE & SHIPLEY Selec Grd Hd, AC MD
20"x6' SEBASTIAN Model R, AC MIB, new 1947
20"x10' LODGE & SHIPLEY Selec Grd Hd, AC MD
20"x8' LODGE & SHIPLEY Selec Grd Hd, AC MIB, taper
22"x10' ROCKFORD 3 SCD DBG QC
24"x12' BOYE & EMMES, Turner Drive, AC MD
24"x14' LODGE & SHIPLEY, Turner drive, taper

MILLERS

#1 CINCINNATI Univ., 4 SCB BG
#2 KEMPSMITH Univ., AC MD, div. hds., vert. hd.
#2 CINCINNATI H.P. Plain, AC MD
#2B BROWN & SHARPE Heavy Plain, AC MD, PRT
#2B MILWAUKEE Plain, DOA, AC MD
#2B MILWAUKEE Univ. DOA, SPD
#2M CINCINNATI Plain, Rect. O.A., AC MIB
#4 CINCINNATI Univ. H.P., Lima Drive
#4B BROWN & SHARPE Plain, AC MIB, DOA
#14 COCHRANE-BLY Univ. Vert. Miller & Shaper, AC MD
#40H INDEX Vert. PF to table, AC MD

SHAPERS & PLANERS

48"x48"x18' PUTNAM Hvy. Duty Planer, with A.C. Mtr. 4 Hds.
14", 16", 20" & 24" GOULD & EBERHARDT H.D.
24" MILWAUKEE V-ram, Lima AC MD
28" AMERICAN H.D., arr AC MD
30"x30"x8' CINCINNATI, AC MD
36"x36"x16' GRAY, 4 hds, AC MD

RADIAL DRILLS

2' & 3' AMERICAN Triple Grd. gearbox
3' CINCINNATI-BICKFORD, AC MD
4' MORRIS, MD
6' CINCINNATI-BICKFORD, mtr on arm
7' DRESES, AC MD thru gearbox

GRINDERS

#16—26" & #16—30" BLANCHARD Vert. Spdl. AC MD
#2 BROWN & SHARPE Univ., factory AC MD
#4 GARDNER BB Disc, 23", AC MD, new 1942
#24—53" GARDNER Vert. Spdl Disc. arr MD

TURRET LATHES

#2B FOSTER Univ. Grd Hd, SPD
#3A WARNER & SWASEY Univ., AC MD, Timken
#4 WARNER & SWASEY Univ., AC MIB, Timken
4W CINCINNATI-ACME Univ., AC MD, threading attach.
#5 WARNER & SWASEY Univ., AC MIB

MISCELLANEOUS

#43 LUCAS Horz. Boring Mill, AC MD, 4½" bar, 20' betw. faceplate and outboard support
10'x10 ga. Geo. Ohl Power Press Brake, AC, MD
#642 NIAGARA 42"x10 ga. Shear

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BENNETT SPECIALS

42"x18"x16' N.B.P. Frog & Switch Planer, 50 h.p. A.C., M.D.
7' Carlton 17' col. Radial, 1943
3½" bar Cinci. Gilbert Table Type Mill, 84" spin. to outer support, 42" spin. to table, 1943.
36"x32' N.B.P. Lathe, 2 carr., T.A.
No. 3K Kearney and Trecker Vertical Miller, 1942
No. 2MH Cincinnati Universal Miller, 1944
No. 3 W. and S. Univ. Turrets, bar, late (3)
20"x144" centers L & S Lathe, Select. Hd.
20"x86" centers Hendey Lathe, T.A., Collets
18'x120" centers Amer. Lathe, T.A., Cone M.D.
5" Sellers Table Type Mill, 48"x120", '42
4" Universal Table Type Mill, 60"x96", '42
48"x19' Niles Heavy Lathe, T.A., '43
36"x36"x12' Cinci. Hypro Planer, '43
48"x48"x24' Gray Planer, '42
36" Bullard Spiral Dr., 3 & 4 jaw, '42

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New Schill Hydraulic Presses, 50-100 Tons, 4 Column, down stroke, Fast Ram Speed, Hydraulic Return, 12" Stroke. Removable Cap Slide with Positive Knockout, Selective Stroke, Pressure Control, Removable Bolster, Bed accommodates drawing attachments. Bliss No. 304 (1942) 55 Tons Straight Side Press, 8" Stroke, 12" Shut Height, Bed 17"x17" Motorized. (2 in stock.)

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No. 2 Brown and Sharpe
No. 61 New Britain 6 spindle 2¼"

DRILLS

No. D-8 Colburn No. 6 Morse Taper
No. 2LMS—26"—2 Spdl. L.G. (1945)
No. 2LMS—26"—4 Spdl. L.G. (1942)
No. 2LMS—14"—4 Spdl. L.G.
No. 2MA6—15"—4 Spdl. Avey
No. 3B—24"—6 Spdl. Edlund (1942)
No. 2—8 Spdl. Leland-Gifford
No. 4 BL Natco—36 Spdls.
7'-15" Col. American Full Universal

GEAR MACHINES

No. 61-A Fellows Gear Shapers (1942)
No. 615-A Fellows Gear Shaper (1942)
No. 712 Fellows Auto Indexing (1943)
No. 18-H Gould & Eberhardt
No. 36-H Gould & Eberhardt
11" Gleason Bevel Gear Cutter
72" Cincinnati Gear Cutter
No. 13 Gleason Univ. Tester

HOR. BOR. MILLS

No. 26 Defiance, 4½" bar
No. 31 Lucas, 3" bar
No. 3A Universal, 3" bar
Rockford, 3⅛" bar
No. 48-A Heald Boremetic

GRINDERS

4"x12" Landis, Model H (1942)
4"x18" Landis Model H (1942)
6"x18" Norton Type C Plain (1943)
6"x30" Norton Type C Plain (1943)
10"x18" Norton Type C Plain (1943)
10"-14"x36" Norton Type C Plain (1942)
Norton Motor Driven Plain Grinders
6"x18" —— to —— 24"x240"
12"x36" Landis Type LCH Universal (1945)
No. 5—8"x24" Covel Hydr. Surf (1941)
24"x24"x84" Mattison Hydr. Surf
No. 34 Abrasive Surface (1943)
No. 22—12" Heald Rotary Surface
No. 25A—24" Heald Rotary Surface (1943)
72A-3 Heald Internal Grinder
72A-5 Heald Internal Grinder
No. 5 Bryant Internal Grinder
No. 16-38 Bryant Internal Grinder
10"x72" Colonial Broach Grinder

LATHES

13"x30" Pratt & Whitney
14"x6' Hendey
15"x5' Sebastian
16"x54" centers LeBlond
18"x6' American
36"x30' Lodge & Shipley
36'—48"x16' Lehman Hydrotrol (1945)
50"x17' centers LeBlond (1942)

LATHES (Production)

8"x15" Sundstrand, Model B (1942)
8"x15" Sundstrand, Model D (1943)
8"x15" Sundstrand, Model E (1942)
10"x22" Sundstrand, Model AA (1943)
12"x18" Lipe Carbo
16"x21" Fay Automatic
16"x33" Fay Automatic (1942)
20"x25" Fay Automatics (1942)

MILLING MACHINES

No. 4 Cincinnati Plain (1943)
No. 2 B & S Univ. Cone Dr.
No. 08 Cincinnati Vert. (1942)
No. 2H Milwaukee Vert. (1942)
No. 2 Cincinnati Vert. (1942)
No. 2M Cincinnati Vert. (1941)
No. 3 Standard Milwaukee Vert.
No. 3 Cincinnati Vert. High Power
No. 1 U.S. Hand Millers
24" Cincinnati Production
No. 1-18 Cinn. Mfg. (1940)
No. 2—18" Sundstrand Electromil (1942)
No. M-18 Milwaukee Simplex (1942)
No. M-24 Milwaukee Simplex (1942)
No. 4-48 Cinn. Hyd. Tracer (1942)
No. 45-48 Cinn. Hyd. Plain Tracer (1942)
No. 56-90 Cinn. Hyd. (1943)
No. 2 Hanson-Whitney Thread
4"x9" Hanson-Whitney Univ. Thrd. Miller
4½"x12" Pratt & Whitney, Model C
6"x20" Pratt & Whitney, Model C
6"x36" Lees-Bradner—Model HT (1943)
6"x48" Pratt & Whitney Thrd. Miller
6"x132" Pratt & Whitney Thread Miller
10"x48" Hanson-Whitney Thread Miller (1942)
12"x24" Lees-Bradner, Model HT (1943)
4" Taylor & Fenn Spline, M.D.
No. 15 Ingersoll Trav. Column Face Miller
24"x24"x12' Ingersoll Adj. Rail
72"x48"x12' Ingersoll Adjustable Rail

MISCELLANEOUS

Model H-7 Micromatic Hydro Honer
Model H-705 Micromatic Hydro Honer
Model 200 Micromatic Hydro Honer
No. 22-C Racine Shear Cut Hack Saw
No. 20 Bliss O.B.I. press
No. 2 V & O O.B.I. press
120" Stamco Shear
No. 0 Bakewell Tapper
Baush Tapper

TURRET LATHES

No. 2 B. & S. Screw Machine, Wire Feed
No. 3 Bardons & Oliver (1942)
No. 5 Warner & Swaseys (1942)
No. 5 Bardons & Olivers (1942)
No. 5 Foster, A.C. & Bar Feed (1942)
No. 2-A Warner & Swasey
No. 1-H Libby, 6¼ Hole in Spindle (1937)
No. 1-H Libby, Extra Long Bed (1942)
18" Libby, 3½" Hole in Spindle
No. 4A Warner & Swasey, 7½" Hole in Spindle

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42" Bullard New Era
52" King
72" Cincinnati
72" Niles Extra Heavy
84" Betts

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7/8", 1¼" & 4½" Cone 4 spindle
1⅞" Conomatic 8 Spindle
1⅝" New Britain No. 61 Six Spindle
2⅝" Acme Gridley 6 spdl. RA6
1⅛" Cleveland 4 Spindle
2"x18" Cleveland, model B
No. 454 New Britain Chucking
14"x19", 16"x33" & 20"x25" Fay
16"—6 station Bullard type D Mult-Au-Matic
8"—6 station Bullard Mult-Au-Matic
No. 2 FU Foster Fastermatic
No. 3D Gisholt Simplimatic
1" type S Economy automatic shaver

GRINDERS, CYLINDRICAL

4"x12", No. 4H Landis hydraulic
6"x18" Norton semi-automatic hydr.
6"x18" Norton type C hydraulic
6"x18" Landis type C hydraulic
6"x18", No. 10 Brown & Sharpe elec. hydr.
Nos. 10 & 11 Brown & Sharpe mechanical
Nos. 1 & 2 Brown & Sharpe universal
No. 13 Brown & Sharpe universal
10"x18" & 10"x50" Norton mechanical
10"x18" Landis Type C hydraulic
10"x24" & 16"x72" Landis mechanical
10"x36", No. 2½ Bath universal
14"x36" Landis type C hydraulic
16"x36" Landis type D semi-auto. hydr.

GRINDERS, SURFACE

18", No. 10 Blanchard rotary
30", No. 16 Blanchard rotary
12" & 16", No. 22 Heald rotary
16" & 24" No. 25A Heald rotary
8" Pratt & Whitney rotary
12" Walker model DA rotary
6"x18", No. 2 Brown & Sharpe
8"x22" Abrasive No. 3
8"x24" Abrasive No. 34 vertical
10"x24" Norton hydraulic
12"x48" Thompson hydraulic
14"x60" Mattison hydraulic
14"x36" Pratt & Whitney vertical

LATHES, TURRET

Nos. 3, 4, 5, 1L & 3AL Gisholt universal
No. 5 Jones & Lamson universal
Nos. 3, 5, 1A & 3A Warner & Swasey universal
No. 2F Foster Fastermatic
No. 5 Foster universal
Nos. 2G & 3 Morey universal
Nos. 4 & 4B Midland universal
Nos. 5 & 7 Bardons & Oliver universal
1½" No. 601 DD Oster
3"x36" & 4"x34" J.&L. flat turret
No. 5 Foster, old style
28" Gisholt, old style
Nos. 4, 4 univ. & 6 W.&S. old style

MILLS, BORING

3" No. 3A Universal horizontal
4", No. 42 Lucas horizontal
7" Barrett cylinder boring
53" & 100" NBP vertical

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Nos. 2AS, 3B & 4B Milwaukee
No. 3 Cincinnati High Speed Dial
No. 3 Van Norman duplex
No. 12 Garvin
No. 3 Cincinnati universal
Nos. 2M, 2, 3, 4 HP Cincinnati vertical
No. 3V Van Norman vertical
Nos. 2H, 3H & 4H Kearney & Trecker vertical
Fray All Angle vertical
Vernon vert. mill & jig borer
No. 2A Pratt & Whitney jig borer

SHAPERS

6" Pratt & Whitney vertical
12" Whipp
16" Milwaukee
16" Gould & Eberhardt
20" Gemco universal
24" Gould & Eberhardt
24" Columbia universal
24" Gemco universal
28" Gould & Eberhardt Invincible
36" Rockford shaper planer

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LATHES

1—Pratt & Whitney 20"x48" Model B geared head motor in base engine Lathe; actual swing 21¼" dist. betw. cens. 48" hole thru spdle 2" 16 spdl. speeds.

BORING MILLS

1—Yoder #3A Hor. Bor. Mill, diam. of bar 3", Morse Taper #5, dist. to outer support 72", bar trav. 24", latest type, motor driven.

1—Bullard 24", New Era Type Vert. Bor. Mill capac. 26" diam., 20" high, 28" under turret face, 2 jaw chuck, coolant, M.D. weight approx. 9,000 lbs.

PLANERS

Cin. 36"x36"x18' Planer 2 heads on cross rail, M.D., heavy duty.

TURRET LATHE

2—Gisholt #3L, hole thru spin. 5¼", sw. over ways 28½", travers of turret carriage 60", bar and chuck. equip., very latest type.

MILLING MACHINE

1—Van Norman #2SU Univ. Mill. Machine, hor. knee type, very latest type, tbl. wkg. surf. 50"x12", feeds long. 24¼", cross 10", vert. 17", motor driven.

1—Milw. #4H Vert. Miller, tbl. wkg. surf. 74"x15¼", feeds: long. 42", cross 14", vert. 16", motor driven, very latest type.

1—B. & S. No. 2 light type, with vert. hed. Pl. Hor. Miller, latest type, tbl. wkg. surf. 45"x10", all power feeds; long. 28", cross 10", vert. 15", spd. range 40-1300 RPM

CHUCKING MACHINES

3—Potter & Johnson Auto. Chuck. Machine No. 6DRE, sw. over bed way 34", sw. over cross slide 21 diam, total turret slide travel 18", with tooling, M.D.

GRINDER

1—Cin. #2 Centerless Grinder Filmatic Bearing capac. 1/16" to 3½" diam. Serial No. 2M2HIL-705 latest type, Hyd. truing attmt, thru feed work rest, wheel profile truing device, auto. infeed attmt., infeed work res; blades and guides and other accessories, practically new, other No. 2 and 3 Cin. Grinders in stock.

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2—Conomatic 8 spindle full Auto. Screw Machines, capac. 1⅞"x6" with elect. equip. and tooling latest type, shipped from fcty. 1945, used very little; also Conomatic 1⅝" 8 spindle.

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#372—53" Besly Disc Grinder
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DOALL V26 METAL BAND SAW, complete with Welding Attachment, Speed Selector.

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WARNER & SWASEY #3 UNIVERSAL Turret Lathe, BAR & CHUCKING, Threading Attachment, Tooling, Taper Attachment.

WARNER & SWASEY #2A UNIVERSAL TURRET LATHE, Bar & Chucking Selector Head, Taper Attachment, Tooling.

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Cincinnati D. H. Planer 36"x36"x10', 2 hds.
Monarch 20" grd. hd., M.D. Lathe 16 sp, Speeds Model "M"
Bullard Vert. Turret Lathes, 24" & 36" S. Head
Defiance 3" Horiz. Boring Mill & Univ. No. 3-A
L & S 18x12' & 20'x10', 20"x8' Grd. Hd., M.D. & 28"x12' Lathes Monarch Model "C"
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American 4-ton vert. Hydr. Broach
Blanchard Vert. Surf. Grinder, 26 rd. chuck
Cincinnati No. 2 Centerless Grinder.
Colburn 60" & 72" Vert. Boring Mills.
Cincinnati 1-M grd. hd., Univ. tool room Miller.
Cincinnati No. 5 H.P. grd. hd, S.P.D. Pl, Miller.
W. & S. No. 2A grd. hd, Univ. Turret Lathe, S.P.D.
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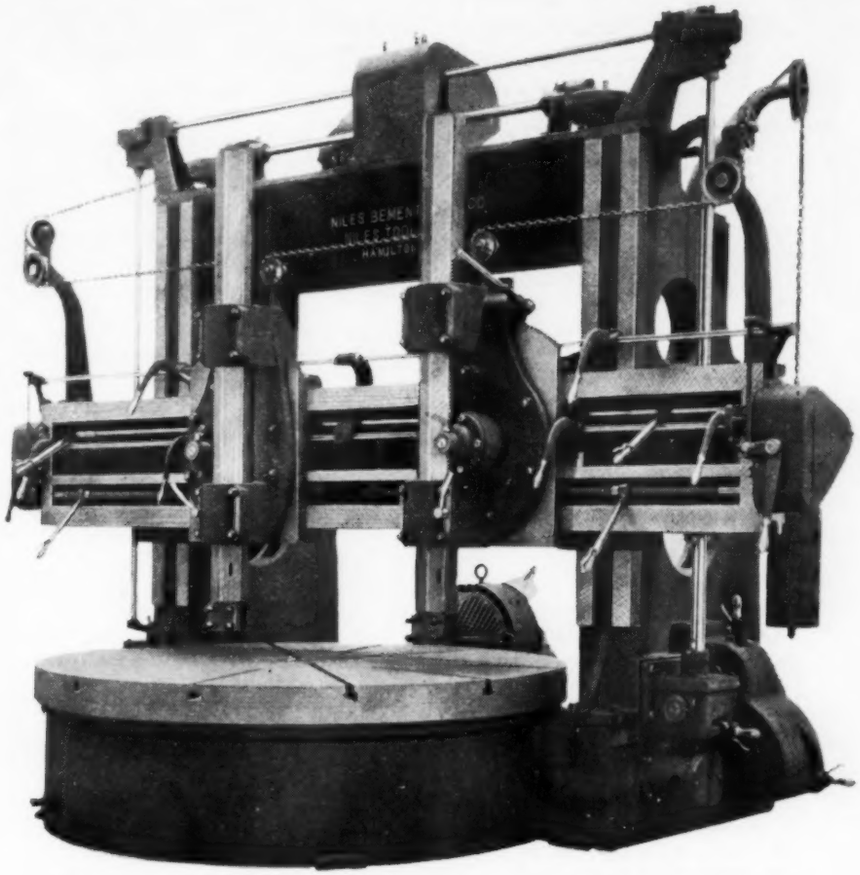

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DETRICK & HARVEY 48x48x16' "HYDRAULIC" Planer, 4 Heads, Motor Drive
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MILLER, Thread, No. 40 Lees-Bradner
MILLER, Duplex, 24" Cincinnati
MILLER, Univ. No. 4 Cincinnati
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PLANER, Openside, 108"x96"x24' D & H
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3" Bar De Vlieg 6' bed, late type
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No. 3 BARDONS & OLIVER, bar feed
No. 3 WARNER & SWASEY, 2 speed motor, bar feed and chuck
No. 4 GISHOLT, bar feed and chuck
No. 5 MIDLAND, chuck
No. 4L GISHOLT—1944, 9⅝" hole, cross sliding hex turret, 24" universal chuck, thread attach., 25 HP motor

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3½" Cincinnati-Gilbert HORIZONTAL BORING MILL, Table Type

#3-L Gisholt Universal Turret Lathe, 4½"

B4B NATCO 48-spdl. "Holesteel" Drill

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You, and other readers of AMERICAN MACHINIST having idle equipment can help new production—and each other—by bringing such equipment to the attention of those who need it, NOW! You can do so through dealers in used equipment. They are recognized sources of distribution and may be able to place the equipment immediately. Or, if you want to contact user-buyers direct, you can do so effectively—at low cost—through advertising in this SEARCHLIGHT SECTION.

The SEARCHLIGHT SECTION serves as an active market place for buying and selling USED and SURPLUS new industrial equipment. It is consulted regularly by prospective buyers of equipment offered by individual plants or dealers. By releasing the idle equipment you no longer need, you can not only aid Today's production schedules but benefit yourself by selling in an active, ready market.

Classified Advertising Division
AMERICAN MACHINIST

ALL THE NEWS ABOUT YOUR BUSINESS!

F-13

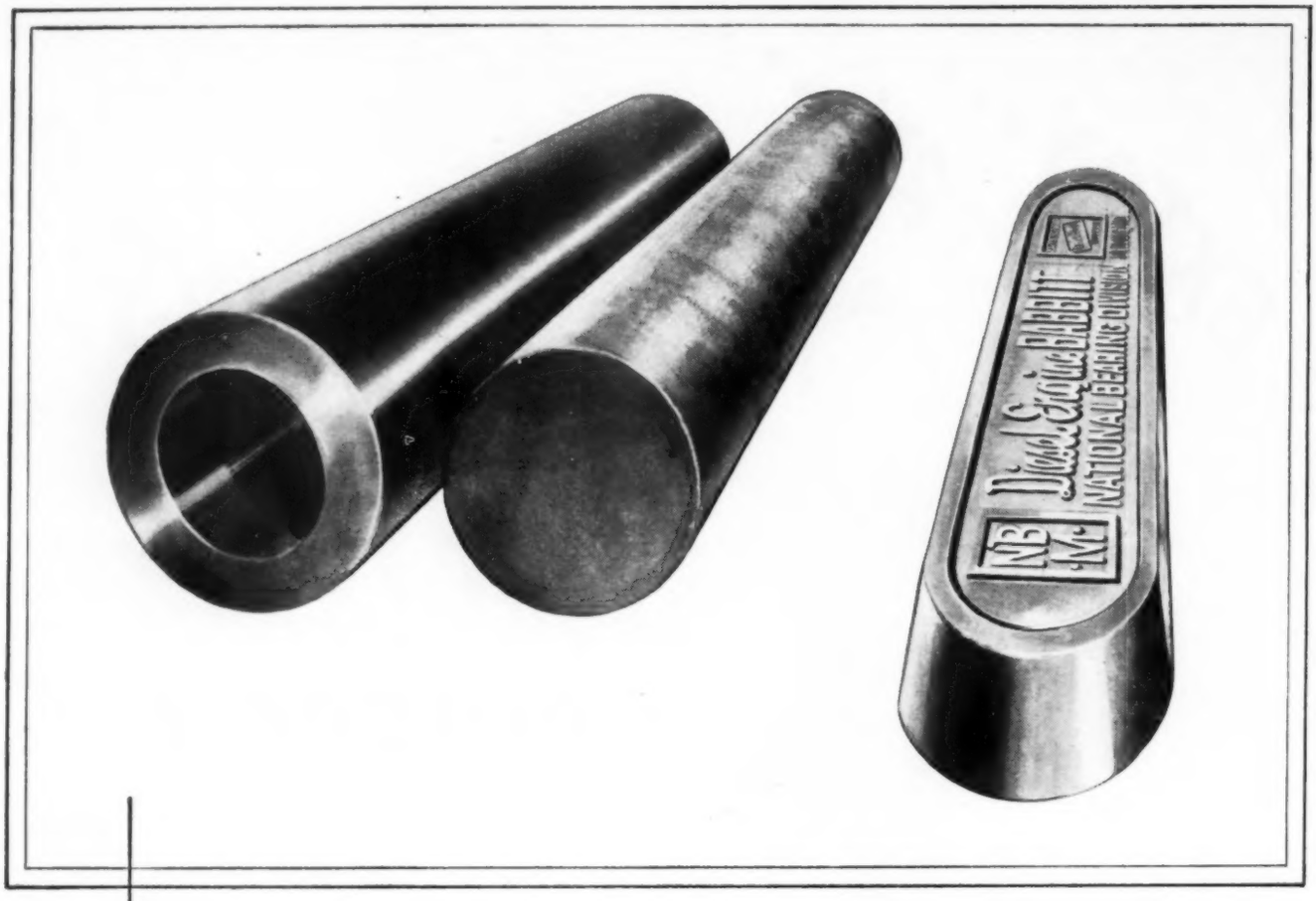
Manufacturers use the advertising pages in this magazine to get *news* about their products or services to *you* . . . quickly and effectively.

Their advertisements contain information designed to help you do your job better, quicker, and cheaper, which is just as newsworthy as the editorial columns.

To be well-informed about the latest developments in *your* business, *your industry* . . . and to stay well-informed . . . *read all the ads too.*

American Machinist

HEADQUARTERS FOR INDUSTRIAL INFORMATION



Custom-Alloyed or Standard Bearing Metals

National Bearing Division offers a complete line of bearing metals— or any type of non-ferrous alloy to required specifications

N-B-M Babbitt Metals have gained nationwide recognition for these important reasons: virgin metals are used exclusively . . . alloys are correctly proportioned . . . blending is controlled. Specify any of the following service-proved babbitts for long range economy and trouble-free service:

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For fewer shutdowns and lower maintenance costs, let National Bearing's unique service take over your bearing problems.

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NATIONAL BEARING DIVISION
ST. LOUIS • NEW YORK

PLANTS IN: ST. LOUIS, MO. • MEADVILLE, PA. • NILES, OHIO • PORTSMOUTH, VA. • ST. PAUL, MINN. • CHICAGO, ILL.

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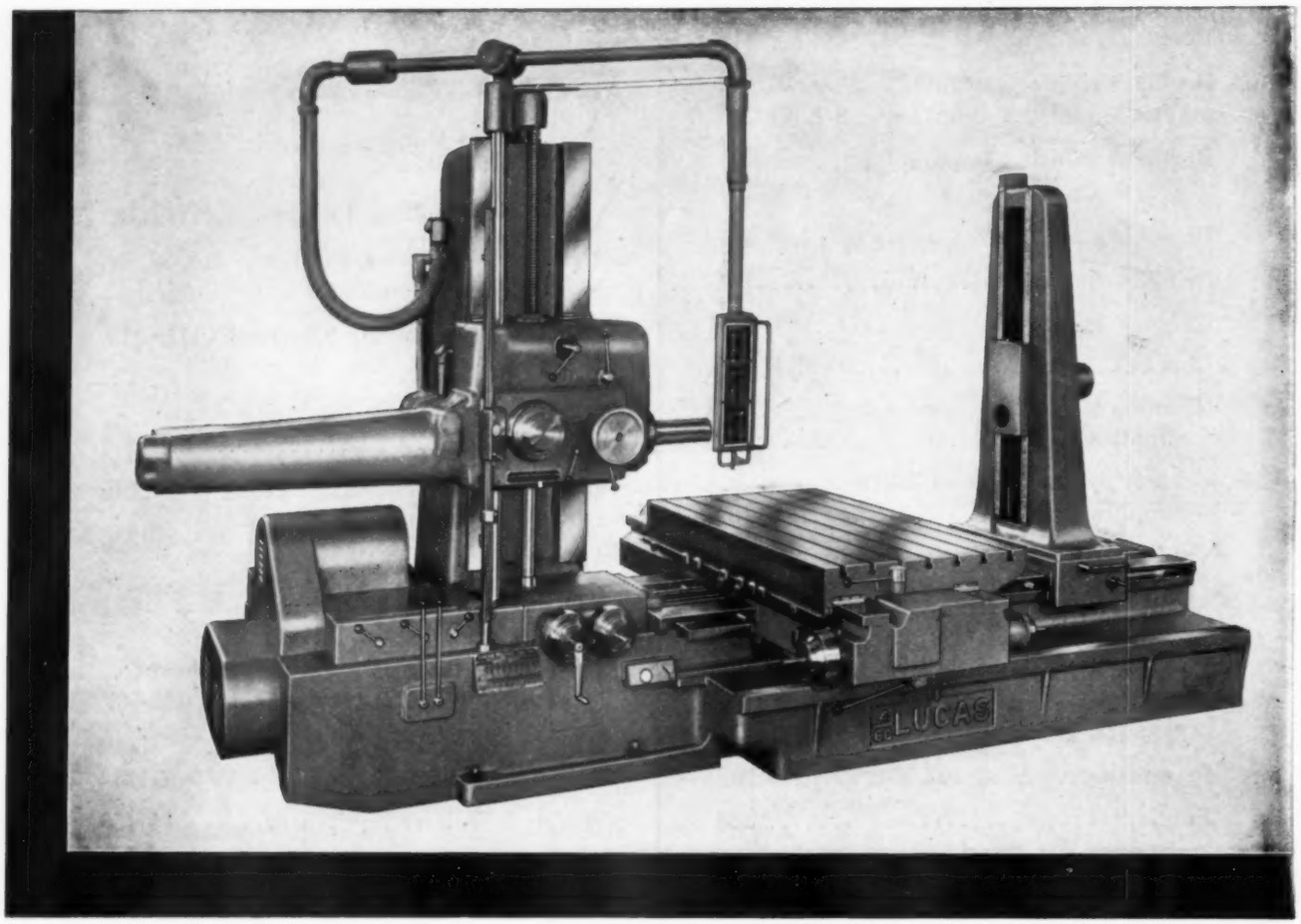
The NEW LOOK in HORIZONTALS

The 4 inch LUCAS with complete electric controls



LUCAS 460 . . . . A NEW CONCEPTION OF CONTROL EFFICIENCY AND PRECISION

● Here is the first LUCAS 4 inch Single Spindle Machine with complete electric controls. This electric touch system was developed to include all movements of the Head, Spindle, Table and Saddle. The speeds and feeds of the machine are manually set but the control of all the movements is through a pendant control station, movable to position desired by the operator.

The LUCAS 460 Electric is complete with improved LUCAS Four-Way Bed. The distance across the outer Ways is 60". Designed for the highest degree of accuracy on long table movements and rigidly supported in a one-piece Bed casting carrying *four hardened steel Ways*. The supports for the Saddle are equipped with hardened steel rollers.

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MACHINE TOOL COMPANY

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CLEVELAND 8, OHIO

MANUFACTURING EXCLUSIVELY 3, 4, 5 AND 6 INCH SINGLE SPINDLE HORIZONTAL BORING, DRILLING AND MILLING MACHINES

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COMMON SENSE ASSEMBLY ENGINEERING

Puts the Heat on Needless Tapping

The many P-K Self-tapping Screws used in this Monitor Automatic Electric Toaster include four Type "F" used to fasten the molded BAKELITE knobs and four Binding Head Type "A" in the assembly of the top strip shell of 24-gauge steel.

"Previous experiences with P-K Self-tapping Screws in both sheet metal and plastic indicated such obvious savings that no other method was considered in the original design," says **Monitor Equipment Corporation,** producer of this automatic "pop-up" electric toaster.

It was estimated that by eliminating the cost of tapping alone, each P-K Screw used saved about ¼¢. Add to this the speed-up of assembly made possible, consider the spoilage avoided, and the savings on thousands of toasters produced mount rapidly to important figures. No wonder Monitor has found it's just common sense to use P-K, *the original* self-tapping screws.

Profit by the experience of the many manufacturers who have switched to P-K and saved up to 50% in assembly work hours. Why use costly, time consuming tapping, riveting, nut-running or mold-slowing inserts in plastic? Besides saving time, the simpler P-K method often makes possible a stronger, better-designed product.

Ask a P-K Assembly Engineer to examine your assembly and show how the simpler P-K method can save for you. Or, mail assembly details for recommendations. Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.

Sold Only Through Accredited Distributors

P-K® *The Original*

A TYPE AND SIZE FOR EVERY METAL AND PLASTIC ASSEMBLY

PARKER-KALON SELF-TAPPING SCREWS

OTHER PARKER-KALON PRODUCTS COLD-FORGED SOCKET SCREWS • HARDENED SCREWNAILS AND MASONRY NAILS • SHUR-GRIP FILE AND SOLDER IRON HANDLES • METAL PUNCHES • DAMPER REGULATORS AND ACCESSORIES

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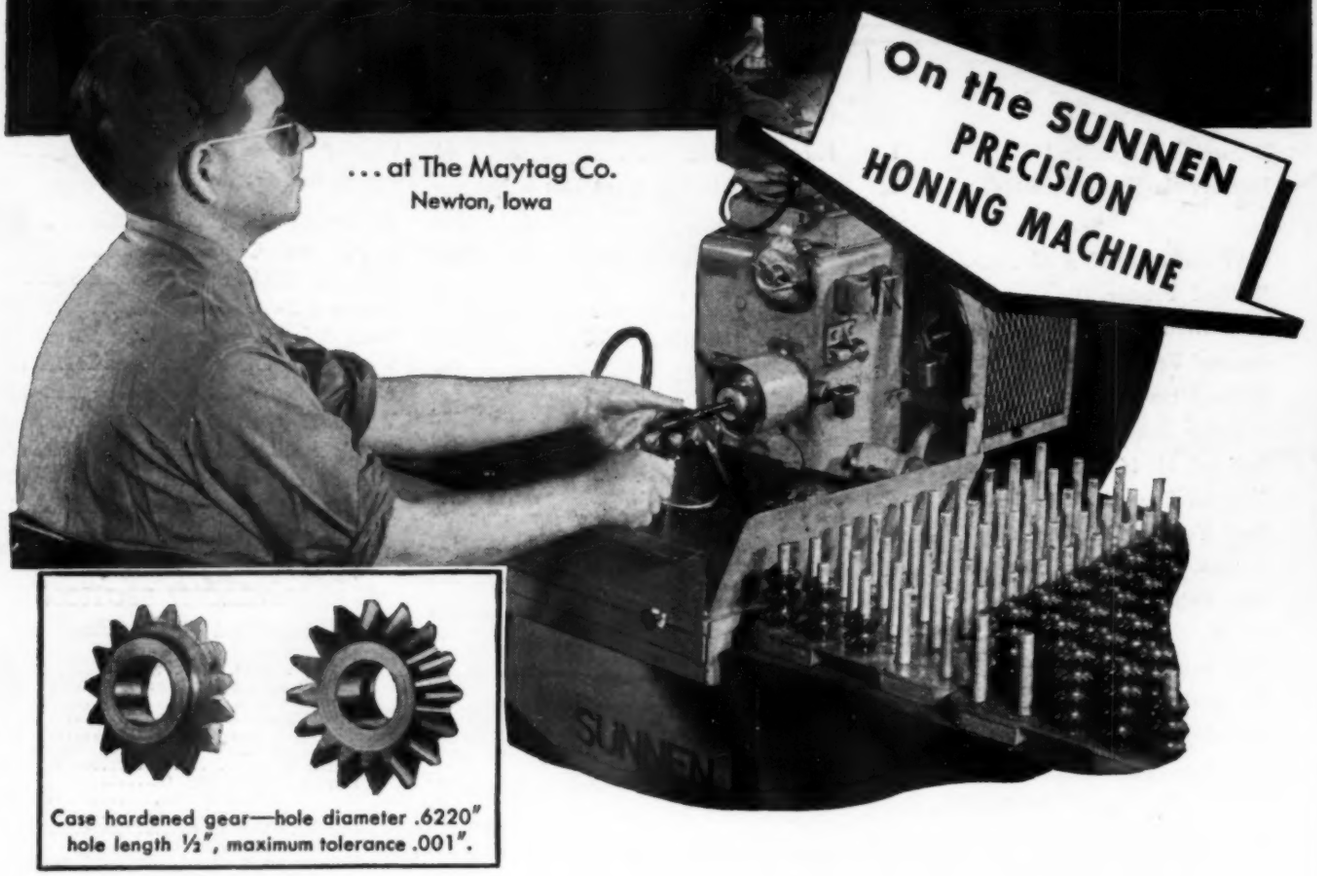
Blind Operator . . .

HONES 183 WRINGER GEARS PER HOUR



Case hardened gear—hole diameter .6220″ hole length ½″, maximum tolerance .001″.

THREE TIMES EVERY MINUTE each operator takes a completed wringer gear off the mandrel of a Sunnen Honing Machine. The internal diameter of this case hardened gear is honed to a smooth finish: straight, round and accurate.

At Maytag five other parts are production honed to produce smooth, accurate internal diameters; to remove heat-treat distortion; to remove burrs—and to lengthen the service life of rotating parts.

When you use Sunnen Honing, set-up time is fast, less than 5 minutes. Skilled labor is unnecessary. Operators, even girls, can be trained in an hour or less.

If your specifications call for finishing of internal diameters from .120″ to 2.625″—accuracy to .0001″, extremely smooth finish, it will pay you to investigate Sunnen Honing.

Write for booklet, or, on request, a Sunnen engineer will call at your plant.

346

SUNNEN

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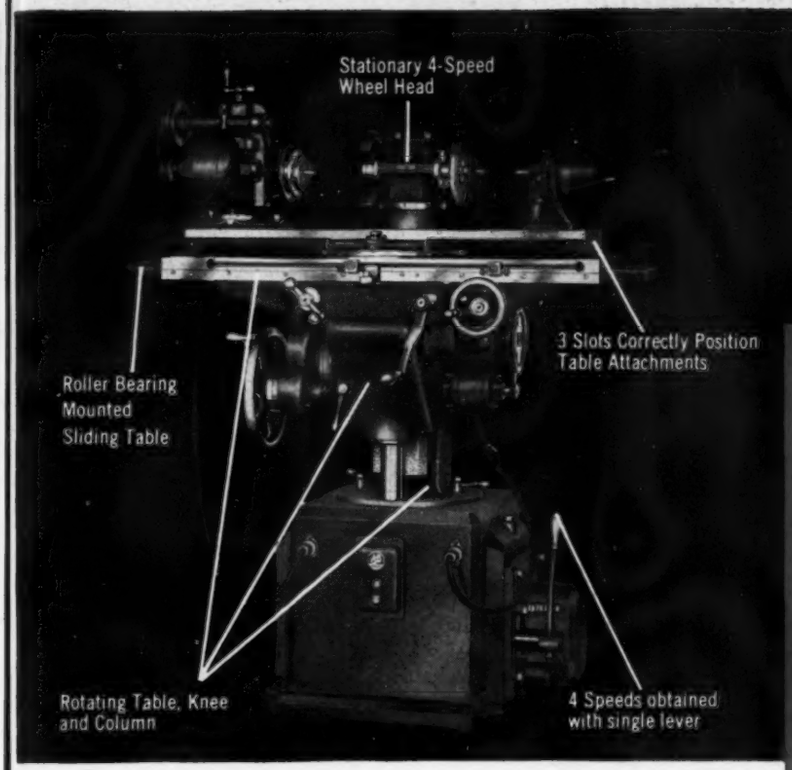
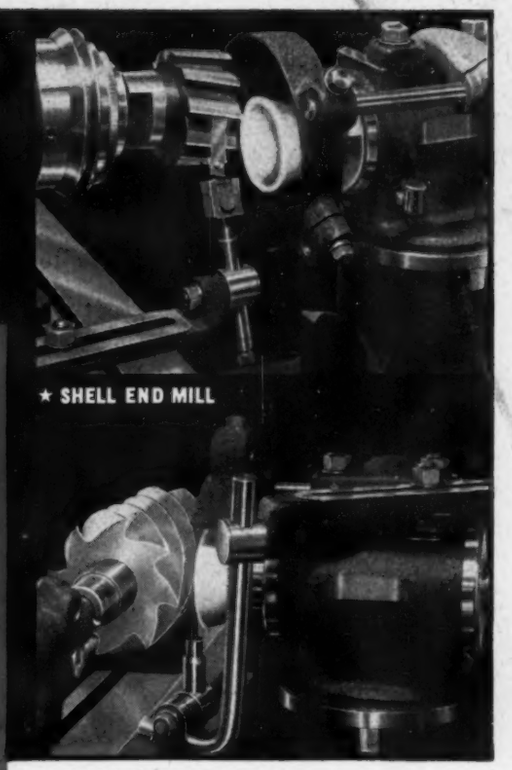
SUNNEN PRODUCTS COMPANY

7930 MANCHESTER AVE. • ST. LOUIS 17, MO.

Canadian Factory: Chatham, Ontario





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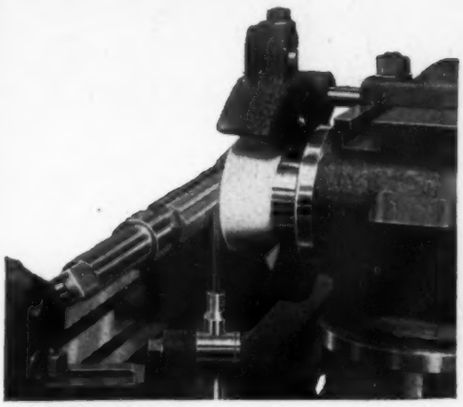
★ SPIRAL MILLING CUTTERS



★ HAND REAMERS

★ STAGGERED TOOTH CUTTER

Get more grinding speeds quicker with the LeBlond No. 2 Universal Cutter Grinder

The "secret" of the LeBlond No. 2 is the stationary wheel head—the only grinder that can give you all the speeds you need easily and quickly. Only on the LeBlond No. 2 can you select four speeds—6500, 5100, 4000, and 3100 rpm—with a single lever.

In addition, the LeBlond No. 2 is one of the most universal of its type. With the generous equipment furnished as standard, you can grind an almost unlimited variety of reamers, mills, taps, and cutters.

Be sure you're getting the speed, capacity, and flexibility you need for modern tool room grinding—get the LeBlond No. 2. For complete information, ask the LeBlond distributor nearest you for descriptive bulletin today.

THE R. K. LEBLOND MACHINE TOOL CO., CINCINNATI 8, OHIO
LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES

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send for

your copy of the No. 2 Cutter Grinder bulletin. The valuable Manual of Tool Room Grinding is also available free of charge.

LEBLOND

"Marked increase in spindle rigidity by using Timken® bearings"

. . . says The Blanchard Machine Company

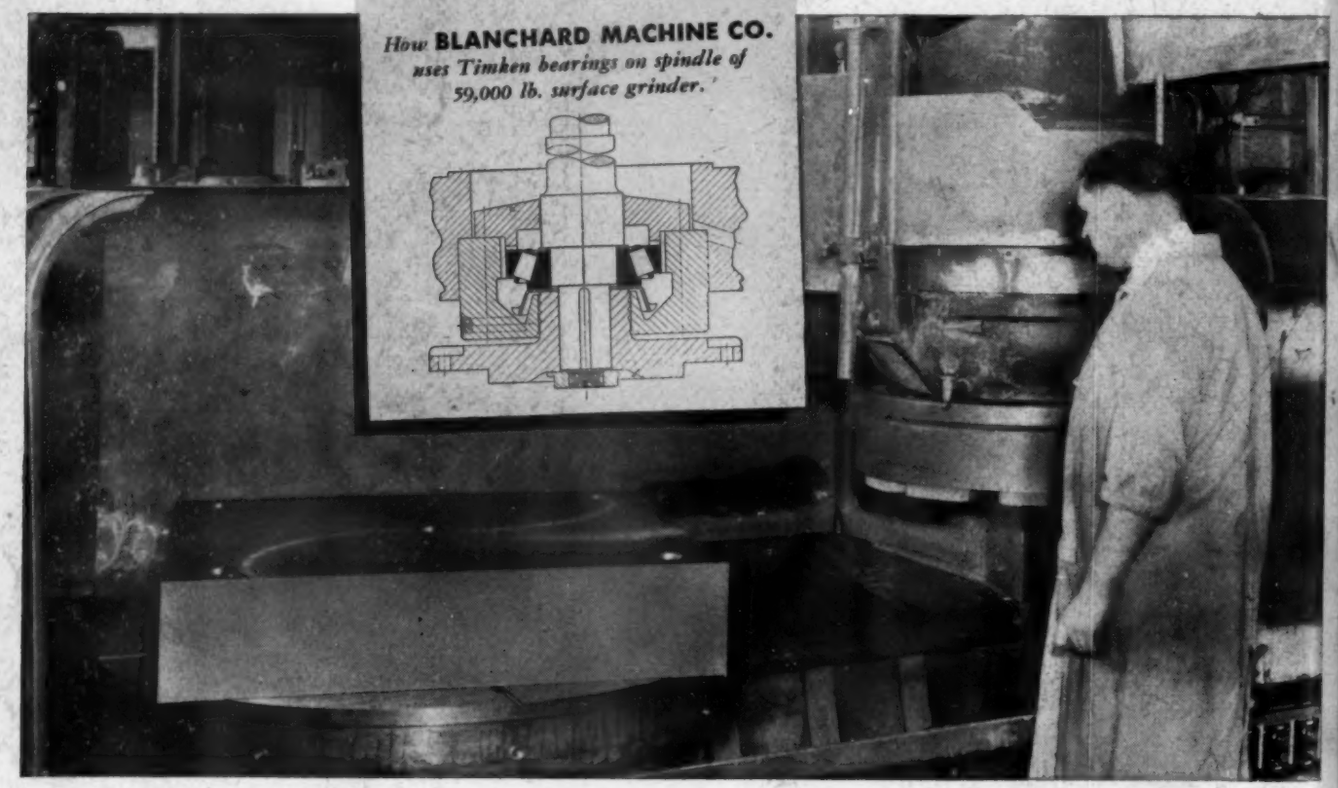
BY using Timken tapered roller bearings at the lower end of the wheel spindles in their 59,000 lb. surface grinders, The Blanchard Machine Company are able to report: "A marked increase in rigidity of spindle was obtained. Deflection of the wheel when grinding interrupted surfaces was much less than with other bearings previously used".

With a Timken bearing on the spindle, the heavy, 42" diameter wheel revolves accurately and smoothly at 400 RPM. The line contact between rolls and races gives the spindle maximum support—no chance of deflection. The tapered construction of the bearing carries both radial and thrust loads in any combination, and permits preloading to any desired degree.

Over the years, the dependable performance and public acceptance of Timken bearings have made Timken-equipped products first choice throughout industry. Timken bearings in your product add a valuable sales feature. When you specify bearings for your product, specify "Timken". And when buying new equipment, always look for the trade-mark "Timken" on the bearings. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

TIMKEN BEARING EQUIPPED

This symbol on a product means its bearings are the best.



TIMKEN BEARING
CAPACITY RATINGS INCREASED 25%.

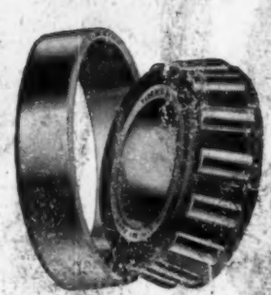
Since Timken bearings were re-rated some 15 years ago there has been such a further and constant improvement in quality that we are now able to announce a 25% increase in radial and thrust load carrying capacity. This may make possible the use of smaller bearings with savings in bearing cost, material cost and weight. Engineers will be able to utilize the advantages of Timken bearings in more applications than in the past.

A new Timken Engineering Journal, now in preparation, will give you complete capacity rating tabulations. For further assistance, write us today.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



NOT JUST A BALL NOT JUST A ROLLER THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL AND THRUST LOADS OR ANY COMBINATION